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UPPAL (B. N.) & CAPOOR (S. P.). **The movement of the virus within the host.**—Proceedings of the Third Meeting of the Crops and Soils Wing of the Board of Agriculture and Animal Husbandry in India, pp. 164–170, 1940. [Received August, 1948.]

The authors make a fresh survey of the literature, and discuss the evidence demonstrating the path of viruses in infected plants [*R.A.M.*, 27, pp. 162, 262], the mechanism of virus movement, and its rate within the host.

HOPKINS (J. C. F.). **Report of Branch of Botany and Plant Pathology for the year ending 31st December, 1947.**—*Rhod. agric. J.*, 45, 4, pp. 330–342, 1948.

In this report on plant disease work in Southern Rhodesia in 1947 [cf. *R.A.M.*, 27, p. 117] it is stated that a blemish which develops on Turkish tobacco leaf and is referred to locally as 'copper sickness' was reported from the Karoe district. The condition appears to be the same as the Italian 'verderame' or 'green spot' [cf. ibid., 3, p. 488; 15, p. 689; 27, p. 201] and is comparable with the 'secondary growth' that develops in mature Virginia tobacco after rain. It is probably attributable in part to cultivation in over-fertile soil, though its development is also associated with climatic conditions. Laboratory tests showed that the blemish could be reduced by delayed harvesting or by sweating the leaves for several days before curing. No infectious organism was associated with the condition.

The ability of potato powdery mildew (*Erysiphe cichoracearum*) to infect tobacco under glasshouse conditions was confirmed. The fungus from potato, however, was less virulent than the usual white mould of tobacco, and is presumably a different strain of *E. cichoracearum*.

As a result of drought, tobacco became susceptible to frog eye (*Cercospora nicotianae*) [ibid., 23, p. 430; 27, p. 200], infection progressing to many of the upper leaves, where it appeared as reddish-brown spots simulating *Alternaria* leaf spot (*A. longipes*) [ibid., 27, p. 118]. Because severely affected lower leaves were not removed by harvest time, intense incipient infection had been set up in all leaves and very severe barn spot developed in curing. This was general in most localities. Under these conditions field spraying failed to give control.

There has recently been a tendency for growers to be less thorough in the precautions taken to eliminate tobacco mosaic, with a consequent increase in many crops. In the drought conditions of 1947 the necrotic type of mosaic ('mosaic scorch') [cf. ibid., 23, p. 153] was widespread.

Following general infestation of the late plantings by aphids, a mild epiphytotic of rosette [tobacco vein distorting plus tobacco mottle viruses: ibid., 26, p. 318] occurred in Virginia tobacco at the end of the season; Turkish crops were not seriously affected. A disturbing feature in areas which received adequate rainfall was the apparently increased virulence of *A. longipes* on tobacco grown on sand veld. Diseases of cigar tobacco in the Chipinga area included wildfire (*Pseudomonas tabaci*) [*P. tabacum*: ibid., 25, p. 529], its report on Turkish tobacco being a new

record for the Colony, frog eye, mosaic, and anthracnose [? *Colletotrichum* sp.; cf. ibid., 24, p. 167; 25, p. 50]; the symptoms differed considerably from those present on Virginia and Turkish varieties.

On two farms in the Umvukwes where rainfall was satisfactory a visible reduction in *A. longipes* leaf spot followed spraying with cuprous oxide, the growers thus being enabled to harvest ahead of the disease. On one farm in the Sinoia area spraying a large area reduced *A. longipes* infection over the whole land, including the control block at one end. The disease, however, developed with great severity in the part of the control block most remote from the sprayed tobacco, the leaf being completely destroyed in the rows farthest away. Unsprayed tobacco of comparable age on land cleared in the bush some 300 yards from the sprayed land was so severely attacked that no leaf was reaped.

Sugar-cane smut (*Ustilago scitaminea*) [ibid., 27, p. 337] continues to appear at Triangle Estates. Early blight (*A. solani*) [ibid., 27, p. 118] appeared on many potato crops during the drought, in some cases cutting down the plants prematurely. It was found necessary to spray early, before the disease appeared, to obtain satisfactory control. Cases of potato bacterial wilt (*Xanthomonas solanacearum*) [ibid., 27, p. 117] were common, but infection was nowhere extensive.

Dahlia tubers imported from Holland during the year were grown under quarantine conditions. Those suspected of harbouring tomato spotted wilt virus (kromnek) [ibid., 27, pp. 118, 299, 421] are being tested. Wild blackberry rust was due to an apparently new species of *Cronartium*. Cabbage black rot (*X. campestris*) was severe during hot, dry weather; the symptoms were quite abnormal, simulating virus infection and insect injury. Tomato mosaic (tobacco mosaic virus) was identified for the first time, necrotic marking of the fruits being a conspicuous feature.

From diseased berries of *Pyracantha angustifolia* two fungi were cultured from the same lesions, a species of *Glomerella* which consistently produced perithecia but no conidia in culture, and a *Gloeosporium* which consistently produced conidia but no perithecia in culture. Inoculated to apple, each set up a distinct (and different) type of rot, not identical with bitter rot (*Glomerella cingulata*) [ibid., 18, p. 784] as commonly seen in the Colony. It is probable, however, that all three can be referred to *G. cingulata* and its conidial forms. If a deciduous fruit industry is to be built up locally, the etiology of bitter rot must be worked out. On the Rhodes Inyanga Estate apples and pears have sustained losses of 50 per cent. The Rhodes pear variety is so susceptible that its continued cultivation may endanger the healthy apple and pear varieties now grown.

New records for the Colony include, *inter alia*, root rot of beet and velvet bean [*Stizolobium deeringianum*] (*Sclerotium rolfsii*) [cf. ibid., 21, pp. 358, 399; 25, pp. 88, 493], fruit rot of apricot (*Botryodiplodia theobromae*), and eggplant (*Phytophthora parasitica*) [ibid., 26, p. 438], plum rust (*Puccinia pruni-spinosae*) [ibid., 27, pp. 139, 386], and sugar-cane wilt (*Cephalosporium sacchari*) [ibid., 26, p. 564].

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, 59, 10, pp. 527–530, 536, 4 figs., 1948.

During late spring and early summer of 1947 coast and tableland grape vines in New South Wales suffered serious losses from *Plasmopara viticola* [*R.A.M.*, 26, p. 143]. Continuous rain in some districts made spraying at regular intervals almost impossible.

Of the new diseases which were recorded in New South Wales during the first six months of 1948 the following are of special interest: *Sclerotinia minor* on groundnut; *Gloeodes pomigena* on nectarine, apple, and peach; *Phytophthora cinnamomi* on peach; *Cylindrosporium betulae*, *Gloeosporium betularum*, and *Melampsoridium betulae* [*M. betulinum*] on birch; *Phoma* (?) *destructiva* on chilli; *Kuehneola fici* on

fig; *Sphaceloma fawcettii scabiosa* on kumquat (*Fortunella japonica*); *Leptothyrium pomi* on apple; and *Soja* virus 1 [soy-bean mosaic virus] and *Cercospora daizu* on soy-bean.

STAPP (C.). **Der bakterielle Pflanzenkrebs und seine Bedeutung im Lichte allgemeiner Krebsforschung.** [The bacterial plant cancer and its significance in the light of general cancer research.]—*Naturwissenschaften*, 34, 3, pp. 81–87, 10 figs., 1947.

Most of the papers cited in this critical survey of important studies on the relation between crown gall of plants (*Pseudomonas* [*Bacterium*] *tumefaciens*) and human cancer have been noticed from time to time in this *Review*.

POSNETTE (A. F.) & STRICKLAND (A. H.). **Parasitism of the mealybug vectors of swollen-shoot of Cacao.**—*Nature, Lond.*, 163, 4133, pp. 105–106, 1949.

The most important vector of the cacao swollen shoot viruses [*R.A.M.*, 27, p. 515], *Pseudococcus njalensis*, is naturally parasitized in the Gold Coast at the rate of about 3 per cent. of the adults with variations consistently as low as 1·7 and consistently as high as 5·4 per cent. in areas only a few hundred yards apart. Of the total adult parasites reared from mealy bugs collected in the field 73 per cent. are referable to *Anagyrus*.

Coffee mealy bugs (*P. kenyae*) parasitized by a biological race of *A. kivuensis* were brought from Kenya to the Gold Coast. This biological race has now been reared through four generations on *P. njalensis*, and has also been reared successfully on *P. citri* and *P. brevipes*. The discovery that one parasite of *P. kenyae* will attack *P. njalensis* indicates that other parasites used to suppress *P. kenyae* on coffee in Kenya might also be used against West African cacao mealy bugs. Investigations along these lines are in progress.

The Agricultural Experiment Stations of Japan.—92 pp., 10 figs., 1 diag., 6 graphs, 5 maps, London, H.M. Stationery Office, [? 1946. Received January, 1949. Mimeographed.]

In the section dealing with plant disease control (pp. 35–38) E. L. WALDEE gives a list of the Japanese names, English common names, and Latin names of the causal organisms of the chief diseases of field crops in Japan, and another of the estimated losses caused by the more important diseases of rice, wheat, and barley for each year from 1941 to 1945, inclusive. Two diseases are discussed, wheat stripe (*Cephalosporium gramineum*) [*R.A.M.*, 13, p. 623; 18, p. 387] and snow damage to wheat and barley. The former first appeared in Okayama Prefecture in 1931. Within three years it was prevalent throughout an area of 3,000 hect. and by 1941, 5,000 hect. in the Prefecture were affected. Control measures reduced the affected area to 2,000 hect. in 1944, but meantime the disease had spread to nine other localities in Honshu and Shikoku. The fungus lives in the soil in plant debris, and may be carried on infected seed, straw, or animal droppings. The disease is thought to have been introduced into one Prefecture on infected grain imported as chicken feed. It is particularly prevalent on upland fields. In rice fields the organism does not usually survive flooding. Infected fields produce little or no grain or badly shrunken grain only. Control consists in the use of clean seed or seed treatment, roguing, avoiding the use of compost made with infected straw, and rotation. In Nagano Prefecture late seeding is recommended.

Snow damage or snow blight is associated with the presence of deep snow (50 cm. or more) persisting for at least 80 days. The injury is caused by fungal infection following carbohydrate exhaustion, and the organisms concerned are *Typhula itoana* [ibid., 15, p. 347; 27, p. 226], *Fusarium* spp., and *Pythium* spp. Two or

more of these fungi may be involved in particular cases, but as a rule one predominates. *T. itoana* is usually most important on barley, *Pythium* on wheat, and *Fusarium* on rye. *T. itoana* predominates in the Tohoku District, *Pythium* sp. in the Hokuriki District, and *Fusarium* in the more mountainous areas.

The control measures recommended include (1) use of resistant varieties recently developed, (2) early sowing, (3) high ridge culture, (4) spraying both plants and surrounding soil surface with Bordeaux mixture or dusting with ceresan before the fall of the first snow likely to persist, (5) sprinkling the snow with soil to accelerate melting, (6) draining away the water from the melting snow, and (7) side-dressing with fertilizers as soon as the soil is dry, in spring. Twelve new wheat and two new barley varieties resistant to the condition and adapted to part of the affected area have been developed in recent years. It is claimed that resistant barley varieties, first distributed about ten years ago, have resulted in a threefold increase in the acreage of this crop after paddy rice in Niigata Prefecture, and that in the mountainous area of the Aizu District of Fakushima Prefecture barley growing is possible only because of the use of resistant varieties.

CRITOPOULOS (P. D.). **Oversummering and overwintering of the cereal rust fungi.**—*Bull. Torrey bot. Cl.*, 75, 5, pp. 492–495, 1948.

The information in this paper has already been noticed from another source [*R.A.M.*, 27, p. 11].

PETERSON (R. F.), CAMPBELL (A. B.), & HANNAH (A. E.). **A diagrammatic scale for estimating rust intensity on leaves and stems of cereals.**—*Canad. J. Res.*, Sect. C, 26, 5, pp. 496–500, 4 pl., 1948.

The Cobb scale and the modified Cobb U.S.D.A. (United States Department of Agriculture) scale as revised by Melchers and Parker [*R.A.M.*, 2, p. 112] were devised for estimating, by means of diagrams (which are here reproduced), the proportion of the area of a leaf or stem of a cereal plant occupied by rust (*Puccinia* spp.) pustules. These diagrams are, however, inadequate, as they are too few, are arranged at intervals that are too large and irregular, and do not illustrate a sufficient range of pustule size. In the present paper new diagrams are presented using smaller, regular intervals of rust intensity and a greater range of pustule size. They are intended for use in connexion with uredosori and teleutosori of *P. graminis*, *P. rubigo-vera* [*P. triticina*], *P. hordei*, and *P. coronata*. They are not suitable for *P. glumarum*.

Large-scale diagrams (19·3 by 7 in.) were drawn on white showcard to represent portions of rusted leaves or stems, the areas representing pustules being outlined in pencil, filled in with Indian ink, and measured with a planimeter. To represent 100 per cent. of rust on the basis of the U.S.D.A. scale, the total pustule area was arranged to be 37 per cent. of the total area, and lower percentages in the remaining diagrams were arranged in proper proportion. With the size of diagram used, 1 per cent. in the U.S.D.A. scale (0·37 per cent. of the total area) is 0·5 sq. in., a convenient unit for planimeter readings. Four series of diagrams with different pustule sizes were prepared, each series having 12 diagrams representing, respectively, 1, 5, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100 per cent. infection, and 0·37, 1·85, 3·7, 7·4, 11·1, 14·8, 18·5, 22·2, 25·9, 29·6, 33·3, and 37 per cent. of the total area occupied by rust pustules. The four series are arranged horizontally one above the other so that the four diagrams making up any one column have equal total areas of pustule. The whole is reproduced in two different reductions to provide an even greater range of pustule size.

The diagram in which the pustules most closely resemble in size and in density of spacing the pustules on the leaf or stem being studied is selected. A more objective

and accurate estimate is obtained with these diagrams than by using those depicting pustules of average size.

A given reading in terms of the U.S.D.A. scale may be converted into an actual percentage reading by multiplying by 0·37, and a given reading in actual percentage into a reading in terms of the U.S.D.A. scale by multiplying by 2·7027. These relationships are true only for those cases where the area occupied by pustules does not exceed 37 per cent. of the total area under consideration. The 100 reading on the U.S.D.A. scale is arbitrarily chosen and represents 37 per cent. rusted leaf area or any value over that figure. Thus in papers where readings of 100, based on the U.S.D.A. scale, are given, the reader is uncertain whether the actual percentage is 37 or more. If workers using the U.S.D.A. or similar scales would record estimates of the actual percentages represented by their scores of 100 the complication would be obviated.

Rossetti (Victoria). **Estudos sôbre a 'gomose de Phytophthora' dos Citrus. I. Suscetibilidade de diversas espécies cítricas a algumas espécies de 'Phytophthora'.** [Studies on the '*Phytophthora* gummosis' of Citrus. I. Susceptibility of various *Citrus* species to some species of *Phytophthora*.]—*Arq. Inst. biol. S. Paulo*, 18 (*1947–48*), pp. 97–124, 3 pl., 2 graphs, 1948. [English summary.]

The high degree of susceptibility to the 'tristeza' form of root rot of the 'sweet orange × sour orange' stock-scion combination, widely used in São Paulo, Brazil [*R.A.M.*, 28, p. 61], led to the investigations, herein fully described and tabulated, on the reactions to foot rot or *Phytophthora* gummosis [ibid., 20, p. 400] of other citrus species and varieties which might replace the sour orange (very resistant to *Phytophthora*) as stocks.

The inoculation experiments were carried out by the method of Klotz and Fawcett [ibid., 10, p. 98], using a specially constructed bark-borer [cf. ibid., 24, p. 80]. The first series, performed in October, 1942, and comprising 980 trees, yielded generally inconclusive results owing to adverse environmental conditions. In the following January further experiments were conducted on sweet orange varieties which had given some indications of resistance in the previous series, and the resultant data were statistically analysed. The varieties were rated in the following order of decreasing susceptibility to *P. citrophthora*: Coronel, Abacaxi, Campista, Mó, São Sebastião, Sanguinea, Ouro, Seléta amarela [yellow selection], Caipira, Cleopatra, Hamlin, Pearson Brown, Cipó, Seleta branca [white selection], Rosa, Caipira Ortolan, Sabará, Pineapple, Lisa Paulista, Mangaratiba, Itaborai, Valencia late, Setubal Barão, Natal, Pera, Côco, and Mandarin. Of these Natal and Pera, which are particularly robust and produce seed of high germinative capacity, are regarded as the most promising for stocks. In another test on 29 varieties of lemons, sweet limes, and citrus hybrids, the grading from high to low susceptibility was as follows: Marfim lime, Thornton tangelo (*C. reticulata* × *C. paradisi*) 116, Eureka lemon, Rio Claro lime, Cristal lime, sweet lemon, Vila Franca lemon, rough lemon E.S.A.P., Gigante lemon, Rangpur lime 94, Rangpur lime 60, Rio Mandarin, sweet lime Maronezi, rough lemon 59, sweet lime 95, sweet lime 97, selvagem [wild] lime, sweet lime 101, sweet lime 100, tangelo 115, Rangpur lime 93, Ponderosa lemon, sweet lime 96, Rangpur lime 92, citrange (*P*[*oncirus*] *trifoliata* × *C. sinensis*), Americana lime, sweet lime 99, and English lime.

Calavan (E. C.) & Wallace (J. M.). **Exosporina branch blight of Grapefruit in southern California.**—Abs. in *Phytopathology*, 38, 11, p. 913, 1948.

In November, 1945, withered branches of Marsh grapefruit trees in the Coachella and Imperial Valleys of California were found to harbour spores of a toruloid fungus beneath the loosened periderm. The blight was frequently associated with an anomalous form of trunk and branch gumming and psorosis, or both. The blight

lesions, though mainly confined to the smaller branches, occasionally extended down primary branches to the trunk. Weak trees appeared to suffer more from the disease than healthy ones. Isolates of the fungus seemed to be almost identical with those of *Exosporina fawcetti* from walnut [*R.A.M.*, 27, p. 102]. Ninety wound inoculations with pure cultures of the fungus from grapefruit were uniformly successful on the trunks, branches, and twigs of the same host, whereas 48 control injuries healed rapidly without infection. *E. fawcetti* was readily recoverable from the lesions thus induced as late as May, 1948.

Bliss (D. E.). **Soil disinfestation in Citrus orchards against Armillaria root rot.**—Abs. in *Phytopathology*, 38, 11, p. 913, 1948.

Armillaria mellea was found to a depth of 9 ft. in sour orange roots in Californian orchards [*R.A.M.*, 25, p. 446]. Carbon disulphide treatments were made in almost undisturbed soils containing inoculated citrus root segments, 15 to 57 mm. in diameter and 17 cm. long, planted at 1-ft. intervals in vertical series 8 or 10 ft. deep. Culture tests were made after 75 or 98 days. Charges of carbon disulphide, applied at 18-in. staggered intervals, eliminated the fungus in the roots as follows: in coarse sandy loam near Azusa 59 ml. at 1 ft. killed from 1 to 7 ft., 118 ml. at 1 ft. from 1 to 8 ft., and 118 ml. at 6 ft. from 3 to 10 ft. In fine sandy loam with a clay-bearing substratum (5 to 6 ft.) and sand near Rivera, 44 ml. at 1 ft. killed from 1 to 3 ft. and both 59 and 88 ml. at 1 ft. killed from 1 to 5 ft. Deep charges were necessary to penetrate the clay substratum. *Trichoderma viride* developed in 54 to 100 per cent. of the cultures from treated roots, but in only 25 per cent. of those from untreated.

Baldacci (E.) & Garofalo (F.). **Disseccamenti dei rami di Mandarino (Citrus nobilis var. deliciosa) dovuti a Bakerophoma tracheiphila.** [Withering of Mandarin (*Citrus nobilis* var. *deliciosa*) branches due to *Bakerophoma tracheiphila*.] —*Ric. sci.*, 18, 5–6, p. 625, 1948.

The occurrence of 'mal secco' (*Bakerophoma* [*Deuterophoma*] *tracheiphila*) on 25-year-old mandarin trees is reported from Conca d'Oro, near Palermo, Sicily [*R.A.M.*, 27, p. 469]. The symptoms of the disease were similar to those on adjacent heavily infected lemon trees, but much milder. Chlorosis of the leaves was followed by withering of the twigs from the tips downwards and defoliation. The slowness of the pathological process in the mandarins constituted the main difference between this species and lemon. There was an appreciable decrease in the yield of the diseased mandarins.

Whitehead (M. D.) & Dickson (J. G.). **The influence of germination temperatures on seedling development of Helminthosporium blight of Oats.**—*J. Amer. Soc. Agron.*, 40, 12, pp. 1092–1099, 1 fig., 1 graph, 1948.

For the evaluation of oat seed for certification by the Wisconsin Certification Agency, the lots are germinated in moistened rolled paper towels by placing them in the refrigerator for four days, followed by transferring to a temperature of 28° C. for another four days, after which they are examined for the development of *Helminthosporium victoriae* and *H.* [*Pyrenophora*] *avenae* [*R.A.M.*, 28, pp. 115, 116]. The amount of infection developing at 20° and below is insufficient to secure a reliable disease rating from the germinator, especially in the case of *H. victoriae*. Seed treatment with semesan jr. reduces the seed-borne inoculum but does not eliminate it even with 14 days' storage after treatment.

Twenty-third descriptive list of varieties of field crops 1948. Flax varieties.—8 pp., Government Committee for the Compilation of the List of Varieties of Field Crops at Wageningen—Netherlands, 1948.

Included in these descriptive notes on a few flax varieties of interest to Dutch

growers and breeders are references to their reactions to rust [*Melampsora lini*], damping-off [*Pythium* sp.], browning [*Polyspora lini*], and foot rot [*Phoma* sp.].

MUSKETT (A. E.) & COLHOUN (J.). **The diseases of the Flax plant (Linum usitatissimum Linn.).**—112 pp., 91 figs. (32 col.), 1 graph, Belfast, The Bursar, Queen's University, 1948. 21*s*.

Some of the information in this useful, attractively produced manual, published under the auspices of the Northern Ireland Flax Development Committee, has already been noticed in the authors' paper on seed-borne diseases of flax and their control [*R.A.M.*, 26, p. 55]. The other diseases herein described, with directions for prevention and control where practicable, are powdery mildew (*Oidium lini*), probably but not certainly the imperfect state of *Erysiphe polygoni* [ibid., 20, p. 466]; *Sclerotinia* disease (*S. sclerotiorum*) [ibid., 1, p. 176; 24, p. 149]; *Rhizoctonia* disease (*Corticium solani*) [ibid., 14, p. 440; 16, p. 611]; damping-off (*Pythium* spp.) [ibid., 24, p. 417]; scorch (*P. megalacanthum*) [ibid., 10, p. 731]; root rot (*Thielaviopsis basicola*) [ibid., 6, p. 420]; *Alternaria* blight (*A. linicola*) [ibid., 26, p. 405] and *A. lini* [ibid., 25, p. 582]; *Fusarium* spp., including (?) *F. culmorum*, which sometimes cause straw-rotting after an attack of stembreak (*Polyspora lini*) [ibid., 15, p. 652] or the 'firing' stage of rust (*Melampsora lini*); 'fire' (*Olpidium brassicae*) [ibid., 11, p. 182; 18, p. 821]; 'pasmo' (*Sphaerella linorum*) [ibid., 22, p. 168]; 'droop' [ibid., 26, p. 339]; heat canker [ibid., 20, p. 466]; hail damage [loc. cit.]; false browning [ibid., 24, p. 313]; bronzing, a condition superficially resembling the browning caused by *P. lini*, but attributed to physiological agencies; flax dodder (*Cuscuta epilinum*); and deficiencies of potassium, responsible for foliar chlorosis and stunted growth in Northern Ireland; nitrogen [ibid., 24, p. 337], rarely observed in the country; calcium (wither top), reported by Millikan from Australia (*Tech. Bull. Dep. Agric. Vict., Biol. Branch*, 2, 1944), but believed to occur also in the British Isles; zinc, described from Australia [*R.A.M.*, 25, p. 342]; iron, from Germany (*Z. PflErnähr., etc.*, 34, pp. 296–311, 1934) and Australia [*R.A.M.*, 24, p. 371]; phosphorus, observed in Australia; copper, experimentally studied in Australia [ibid., 25, p. 114]; and magnesium.

Of the fungal diseases of flax listed above, *C. solani*, *Pythium* damping-off, *P. megalacanthum*, and *A. lini* have not been reported from the British Isles, nor *S. linorum* from the United Kingdom, though it occurs in Eire.

Research on bacterial diseases of flax has hitherto been largely confined to the U.S.S.R. An epidemic attributed to the beet curly top virus occurred in California in 1944 [ibid., 25, p. 34], this being the first report of a virus disease of flax.

In 1944 a remarkable failure of the flax crop occurred in the Braid Valley district of Co. Antrim, particularly heavy damage being sustained in the eastern portion, where nearly 1,000 acres were involved. The trouble, known as the Braid Valley disease, first becomes noticeable, in the form of patches where growth has ceased, in early June when the plants are 6 to 9 in. in height. The denuded areas expand and ultimately the plants die and disappear, so that by mid-July the crop may have become a total failure in severe attacks. The symptoms bear a superficial resemblance to those of wilt (*F. lini*), but distinct differences are revealed by a close examination. The plants assume a generally sickly appearance, with well-marked chlorosis, especially in the basal region, and growth ceases completely. The lower leaves fade and die, while those round the growing point remain green and the plant acquires a tufted aspect due to the crowding of the leaves at the apex consequent on the slowing-down of growth. The stem also remains green. After the cessation of growth the plants dwindle and finally collapse. Small lateral branches are occasionally produced from the cotyledonary axils. No lesions of any kind have been observed, nor has any parasitic organism been found associated with the disease. There is, moreover, no evidence that nutrient deficiencies are responsible,

nor can it be referred to any special circumstances connected with the siting of the land or a particular system of crop husbandry. It does seem, however, that the white-flowering varieties, e.g., Concurrent, normally cultivated in the Braid Valley but unavailable during the war period of 1939 to 1945, are more resistant than the blue Liral Prince and Stormont Gossamer.

Appendix I deals with the Ulster method for the detection of seed-borne parasites [ibid., 27, p. 173]; II with seed disinfection; III with the production, certification, and disinfection of seed; and IV with the measures necessary to produce a healthy crop, especially sound husbandry and hygiene.

HEAN (A. F.). **A wilt disease of Crotalaria juncea Linn. (Sunn Hemp) found in South Africa.**—*Sci. Bull. Dep. Agric. S. Afr.* 255, 15 pp., 1947. [Received January, 1949.]

The wilt disease of irrigated crops of *Crotalaria juncea* in South Africa caused by *Fusarium moniliforme* [*Gibberella fujikuroi*] var. *subglutinans* [*R.A.M.*, 24, p. 219], which may reduce stands by 30 per cent. or more, appears to be spreading and increasing in severity and may soon endanger the growing of the crop. Severe infection occurs in parts of the Nelspruit district of the eastern Transvaal, while light to moderate infection has been reported from the Pretoria district, the Brits and Rustenburg areas of the western Transvaal, and the Fort Beaufort area of the eastern Cape Province where the disease has been present for some years.

The first symptom is usually a slight wilting of the plant tip. Short, brown, slightly sunken streaks may be present on the stem from ground level up to a height of 12 inches or more. Internally brown streaks extend from the roots, which are brown and rotted, for some distance up the stem. The collar region is often cracked. In three cases infection of sunn hemp grown under irrigation was seen to begin low down in the stem where a branch had broken off.

In culture the fungus, isolated consistently from all parts of diseased plants and from spores on the outside of diseased stems, grew best at 27° C. Hyphal threads were seen in stems, roots, and collar, generally in the vessels, of many diseased plants. Dr. Doidge identified the causal organism and also *F. solani* var. *martii* and another species (? *F. vasinfectum*) associated with it. The pathogenicity of *G. fujikuroi* var. *subglutinans* was established in greenhouse tests carried out from 1937 to 1940. The disease was induced in plants sown in soil inoculated with the fungus on rice grains, or watered with suspensions of spores before or after sowing, or containing pieces of the roots and stems of infected plants.

The results of various tests, although not conclusive, showed that seed transmission is probably negligible. The stand of seed treated with one or two proprietary brands of fungicidal dust was superior to that of untreated seed.

Isolations from the stems of plants kept in the laboratory showed that the fungus was still viable after ten months. Cultures over a year old gave actively growing colonies when transferred to fresh media. Some infection resulted in plantings made in soil kept for six months.

Globose, dark, purplish-blue perithecia, the largest measuring 300 μ in diameter, developed on pieces of diseased stem kept on damp filter-paper in Petri dishes. The greatest length for the oblong-clavate asci was 76 μ, with a diameter of 8 μ. This difference in size from that reported by Edwards [ibid., 13, p. 299; 15, p. 359] may be due to the immaturity of this stage of the fungus or may prove a constant feature of this strain. The monostichous or incompletely distichous, ellipsoid or sub-clavate spores were rounded at the ends and uni- or often triseptate. This feature appeared in all the perithecia examined; only very rarely was a biseptate spore seen. The triseptate spores measured 16 to 13·5 by 4 to 3·5 μ and the uniseptate ones 15 to 10·5 (average 12·6) by 4 to 3·5 μ; all of which were immature but taken from the most fully developed perithecia. No perithecia have yet been seen in the field.

The control measures recommended are a rotation of at least three years, seed treatment with fungicidal dusts to protect the seedlings from an early attack of wilt, the removal of diseased plants before ploughing, and the prevention of irrigation water flowing from diseased to healthy plants.

SMITH (F. F.) & BRIERLEY (P.). **Simulation of Lily rosette symptoms by feeding injury of the Foxglove aphid.**—*Phytopathology*, 38, 11, pp. 849–851, 2 figs., 1948.

The symptoms induced in Easter lilies (*Lilium longiflorum*) by feeding injury of the foxglove aphid (*Myzus convolvuli*) in a Long Island greenhouse closely resembled those of the lily rosette virus and further suggested the presence of the lily mottle virus [*R.A.M.*, 28, p. 174]. Neither of these diseases, however, is carried by *M. convolvuli*, and the downward curling of the young foliage, and irregular yellow mottling of the old, must therefore be attributed to feeding injury.

The lily disease in Ceylon referred by Gadd and Loos to the cucumber mosaic virus [ibid., 19, p. 479] is also believed to be due to colonization by *M. convolvuli*. Specimens of the green aphid from Ceylon were identified at the Agricultural Research Centre, Beltsville, Maryland, as *M. convolvuli*, which is not a vector of cucumber mosaic virus. Gadd states also that in Ceylon the lily diseases are caused by a virus complex including both necrotic fleck and rosette.

JEHLE (R. A.). & JENKINS (ANNA E.). **Cases of scab on Violet and Pansy in Maryland.**—*Phytopathology*, 38, 11, pp. 925–928, 1 fig., 1948.

Further data are given relative to the case of violet scab (*Sphaceloma violae*) in a small commercial greenhouse in Maryland in 1936 reported by Walker *et al.* [*R.A.M.*, 26, p. 153]. The full-grown plants, purchased from a northern grower, were diseased when received and a few months later only a few of the less severely infected ones were fit to be removed from the greenhouse and planted in the open. In the autumn of 1947 Oregon Giant pansy seedlings, raised from home-grown seed in frames in the same nursery, were also heavily attacked by *S. violae*, which may well have spread from the infected violets. In the same season self-sown wild violets near the pansies and in other parts of the premises were also diseased. These instances of severe scab infection on violets and pansies growing in close proximity are considered to afford implications of economic significance.

SCHAEFER (E. E.). **Rhizoctonia stem-rot of Carnations.**—*Fmg S. Afr.*, 23, 272, pp. 742–743, 1948.

The most destructive carnation disease in Transvaal is stem rot, caused by a species of *Rhizoctonia* [*R.A.M.*, 17, p. 249]. Infection is usually noticed first when the plant loses colour. The leaves wilt and wither rapidly and within a week or two the plant dies. The rotted stem, to which particles of sand and plant material are often attached by short mycelial threads, easily breaks off at ground-level.

In the very early stages the disease may be cured by watering with a fungicide. Prevention by growing healthy plants under the best possible conditions in soil with good natural drainage is advised. Where the drainage is not adequate, carnations should be planted, not too deeply, on ridges rather than in furrows, and should not be over-watered or watered during the latter part of the day. Level or very slightly sloping plots with non-acid and not excessively manured soils are the most suitable.

TERRIER (C. A.). **Calendula officinalis L., hôte occasionel de Coleosporium senecionis (Pers.) Lév.** [*Calendula officinalis* L., an occasional host of *Coleosporium senecionis* (Pers.) Lév.]—*Ber. schweiz. bot. Ges.*, 58, pp. 202–206, 2 graphs, 1948.

In August, 1946, self-sown *Calendula officinalis* plants at Saxon (Valais) were

attacked by a rust later identified as *Coleosporium senecionis*. Neighbouring plots of *Calendula* were invaded by *Senecio vulgaris* and *Sonchus oleraceus*, which bore numerous uredosori of *Coleosporium senecionis* [*R.A.M.*, 25, p. 280] and *C. sonchi* [*C. sonchi-arvensis*: cf. ibid., 5, p. 252; 23, p. 156], respectively. A few clumps of *Calendula* inoculated with uredospores of *Coleosporium senecionis* on 30th August produced uredospores on 6th October, whereas those inoculated with *C. sonchi-arvensis* were unaffected. At the end of the season the teleutosori could not be found on *Calendula* (from which the rust had disappeared), though abundant on *Senecio vulgaris*. Towards the middle of August, 1947, infection appeared again at Saxon on *Senecio vulgaris* and on *Calendula*, spreading rapidly on the former but remaining stationary on the latter, which confirmed the author's view that infection occurred only by means of the aecidiospores. When rusted *Senecio vulgaris* plants were set in a clump of *Calendula*, uredosori developed [on *Calendula*]. Potted *Calendula* plants growing indoors were also experimentally infected with uredospores of *Coleosporium senecionis*.

CHILDERS (W. R.). **Record of the occurrence of Physoderma graminis in Canada.**—*Science*, 108, 2809, p. 484, 1948.

Agropyron repens near the Central Experimental Farm, Ottawa, has been found to be infected by *Physoderma graminis*, hitherto recorded in North America only from Wisconsin [*R.A.M.*, 27, p. 240]. The diseased plants are dwarfed owing to suppressed culm elongation and bear yellowish to brown stripes. They are conspicuous in close-mown fields by reason of their stiff, erect leaves and general chlorotic appearance. Although *A. repens* is of no economic importance, the possibility that the fungus may spread to other more valuable grasses should be borne in mind.

RICEMAN (D. S.) & POWRIE (J. K.). **Mineral deficiency in plants on the soils of the ninety-mile plain in South Australia. III. Differences in the behaviour of the Dwalganup and later-flowering varieties of Subterranean Clover.**—*J. Aust. Inst. agric. Sci.*, 14, 3, pp. 138–140, 1948.

The subterranean clover [*Trifolium subterraneum*] Bacchus Marsh grows vigorously on the poor, sandy soil of the ninety-mile plain in South Australia, when zinc, copper, and small quantities of superphosphate are added [*R.A.M.*, 25, p. 362]. Dwalganup, on the other hand, was found to persist without the additional minerals, but remained unthrifty even with the addition of a wide range of nutrient elements. Preliminary trials showed that exceptionally heavy dressings of superphosphate together with zinc and copper had a beneficial effect on its development.

THIRUMALACHAR (M. J.). **Angular leaf-spot of Kudzu in Mysore.**—*Curr. Sci.*, 18, 1, pp. 16–17, 1949.

Kudzu (*Pueraria thunbergiana*) [*P. hirsuta*] grown for experimental purposes at Bangalore, Mysore, has been attacked by a *Cercospora* (? *C. puerariicola*, the conidial state of *Mycosphaerella puerariicola*, which causes a similar disease on the same host in Georgia, United States) [*R.A.M.*, 27, p. 478]. The pathogen was responsible for the development on the leaves of light, later dark brown, angular lesions, resulting in defoliation when large areas were involved. The hyaline, obclavate to cylindrical, up to 15-septate conidia, 85 to 170 by 3 to 3·5 μ, are borne on simple, olive-brown, uni- to sexseptate conidiophores, 85 to 180 by 3·5 to 4·5 μ. These dimensions are larger than those reported for the fungus in Georgia (conidiophores 20 to 84 by 4 to 4·5 μ, conidia 25·2 to 126 by 3 to 5·3 μ).

This record of *M. puerariicola* on *P. hirsuta* grown from imported seeds is of interest since no species of *Cercospora* has been reported from India on the host in question or *P. tuberosa*, the only indigenous species known in South India. Care

should be taken to prevent the spread of the leaf spot in the event of large-scale cultivation of the host.

Darpoux (H.) & Vuittenez (A.). **Essais de traitements contre la tavelure du Poirier.** [Experimental treatments in the control of Pear scab.]—*Ann. Epiphyt.*, N.S., *Sér. Path. vég., Mém.* 1, pp. 7–26, 2 pl., 5 figs., 3 graphs, 1948.

This information has already been noted from two papers from another source [*R.A.M.*, 27, p. 531].

Louw (A. J.). **A leafspot disease of Pears.**—*Fmg S. Afr.*, 23, 272, pp. 737–741, 743, 2 figs., 1948.

During the seasons 1940–1 and 1941–2 pears in parts of Elgin and Somerset West of Western Cape Province, South Africa, were severely affected by white spot [leaf fleck] disease, the primary infections originating from the ascigerous state of the fungus *Mycosphaerella sentina* [*R.A.M.*, 26, p. 533], numerous perithecia of which were found on over-wintered pear leaves. In October, 1941, ascospores were trapped in abundance over dead pear leaves. Besides causing direct damage to leaves and fruit, the disease aggravates leaf scorch and favours spray injury. Doyenne du Comice, Packham's Triumph, and Winter Nelis possess a high degree of resistance, while Beurré Bosc is very susceptible.

Effective control was obtained on Beurré Hardy trees by four sprayings at bud-burst, green-cluster, petal-fall, and post-blossom stages with (in decreasing order of efficacy) verderame, copper oxychloride (5–100), lime-sulphur (1–100), wettable sulphur (5–100), zinc sulphate-lime (5–5–100), and orthol K summer oil (1–100). It is feared that if insecticidal summer oil sprays are replaced by DDT the disease may become more general and severe.

Lewis (F. H.) & Groves (A. B.). **Control of Cherry leaf spot in the Cumberland–Shenandoah Valley.**—*Bull. Pa agric. Exp. Sta.* 498, 40 pp., 4 figs., 1948.

This is the second general report of the cherry spray investigations, conducted co-operatively by the Pennsylvania, Virginia, and West Virginia Experiment Stations [cf. *R.A.M.*, 23, p. 180] and covers the years 1943–7. Leaf spot, caused by *Coccomyces hiemalis* [ibid., 27, p. 570], is the most important disease of sour cherries in the Cumberland–Shenandoah Valley and the main factor responsible for the recent numerous tree deaths, severe injury, low yields, and low-quality fruit in that area.

The effects of failure to control leaf spot in one year on the yield, health, and vigour of the trees in the following year are still a cause of controversy. On the Virginia experimental plots during the late summer of 1945 the conspicuously smaller size of buds on the unsprayed trees compared with those on ones which had retained their foliage was noticeable. The average bud weight on trees sprayed with compound 341 was 147 mg., and on the unsprayed 90 mg.; these latter did not survive the winter.

The worst outbreak of *C. hiemalis* on record occurred in 1945, and in the following spring in northern Virginia several previously healthy sour cherry trees died for no apparent reason other than exhaustion following the previous year's leaf spot defoliation. Confirmation of this diagnosis was found in a block of young trees used for experimental spraying. The unsprayed trees, distributed as entire rows at intervals throughout the block, were at blossom-time, 1946, entirely devoid of bloom or active leaf buds; they eventually died. None of the sprayed trees died although dithane had delayed defoliation by about four weeks only. Six-year-old and previously well cared-for trees in two orchards near Winchester were all killed. In both instances the trees were unsprayed after the crop was destroyed by frost in the spring of 1945.

The importance of giving adequate consideration to the effect of fungicides on fruit quality, in the development of new spray schedules, is emphasized. The fungicide used may influence fruit yield, size, colour, solid content, pH, total acidity, weight of the seeds per pound of fruit, limb rub, cracking in wet weather, shrivelling in dry weather, and spray injury. Apart from injury, size is considered to be the most important fruit character affected by fungicides.

The results indicate that two or three different fungicides are needed in the cherry spray programme. Bordeaux mixture is fairly satisfactory as a post-harvest spray. Lime-sulphur, the proprietary copper fungicides (Tennessee 26, copoloid, copper hydro, copper A, cupro-K, and bordow), and compound 341 [ibid., 25, p. 402] may be used as pre-harvest sprays. A suitable formulation for 341, however, needs to be prepared and standardized before its place in the cherry spray programme can be determined.

[This bulletin, under the same authorship, is also printed as *Bull. Va agric. Exp. Sta.* 415.]

KOTTE (W.). **Krankheiten und Schädlinge in Obstbau. Zweite Auflage.** [Diseases and pests in fruit culture. Second edition.]—viii+329 pp., 8 col. pl., 216 figs., Berlin, Paul Parey, 1948.

This useful manual, the first edition of which appeared in 1940, falls into five sections, dealing with (A) the economic importance of plant protection in fruit culture; (B) the causes of injury to German fruit; (C) diseases and pests of different kinds of fruits; (D) pest and disease control in fruit culture; and (E) a key for the determination of the principal fruit diseases and pests, followed by a list of leaflets of the Biological Institute and other publications of practical utility to the fruit-grower.

VAN DE POL (P. H.). **De schurftwaarschuwingsdienst.** [The scab warning service.]—*Fruitteelt*, 38, 15, pp. 228–229, 3 figs., 1948.

The apple and pear scab [*Venturia inaequalis* and *V. pirina*] spray warning service in Holland is based on the dual criteria of ascospore liberation and bud development [*R.A.M.*, 26, p. 63]. Beginning shortly before the first ascospore discharge is expected, series of at least 20 leaves are wetted and examined under the microscope after 4- and 24-hour intervals. Six to eight days after the beginning of profuse ascospore discharge under the warm and humid conditions prevailing in the laboratory, correspondingly abundant 'flights' may be anticipated in the open. For purposes of verification some 100 leaves from various parts of the country are kept out of doors and examined after rain for the presence of ascospores. Eight years' observations in five provinces revealed no material discrepancies in the dates of ascospore liberation.

The exact stage of bud development in different parts of the country has also to be considered in relation to the publication of spray warnings. Buds in the 'mouse ear' stage, for instance, are obviously exposed to greater risks of infection, the amount of infective material being equal, than those that are only just opening. The phases of bud development are in turn dependent on weather conditions, and a very valuable daily contact is maintained between the Meteorological Institute and the Plant Protection Service, the spray warnings of which, based on information received, are promptly included in the wireless weather reports. In 1948 the first warning was issued on 20th March, by which time ascospore discharge was increasing on the artificially wetted leaves and some dissemination had already occurred in the open. Moreover, in the southern districts to which the warning was primarily addressed, the buds of certain apple and pear varieties had reached the 'mouse ear' stage and were liable to infection at any moment.

Colhoun (J.). **Nitrogen content in relation to fungal growth in Apples.**—*Ann. appl. Biol.*, 35, 4, pp. 638–647, 3 graphs, 1948.

Investigations were carried out at the Imperial College of Science, London, on the effect of changing the concentrations of nitrogen (as asparagine), malic acid, and sugar in a standard agar medium on the rate of spread of *Cytosporina ludibunda* strain CE [*R.A.M.*, 13, p. 524; 19, p. 283] and *Fusarium fructigenum* strain D [*F. lateritium*: ibid., 13, p. 583]. With nitrogen increasing between 0·002 (no asparagine added) and 0·03 per cent. the extent of radial growth in nine days of *C. ludibunda* decreased when acid concentration was low, increased when it was high, and remained fairly constant at medium acid concentrations. With the nitrogen content increasing between 0·03 and 0·06 per cent. the spread of the fungus was relatively the same whatever the acid concentration. Similar results were obtained with *F. lateritium* except that the acid content at which the reversal of the relationship between radial spread and nitrogen concentration occurred was lower than that for *C. ludibunda*.

The presence of lentil or apple extract in the media increased the radial growth in five days of *C. ludibunda* and lowered the acid concentration at which the change from the direct relationship between spread and nitrogen content occurred. The response of the fungi to nitrogen appears to be only slightly affected by variations in the concentration or kind of sugar present.

C. ludibunda inoculated into apples showed similar response to nitrogen content as it did in media, except that the radial spread was greatly affected when the nitrogen content of the fruit was increased above 0·03 per cent. [ibid., 17, p. 826].

English (H.). **Disinfectant washes for the control of decay in Apples and Pears.**—Abs. in *Phytopathology*, 38, 11, p. 914, 1948.

Of the phenol derivatives tested for the control of apple blue mould (*Penicillium expansum*) and bull's-eye rot (*Gloeosporium* [*Neofabraea*] *perennans*) [*R.A.M.*, 26, p. 456] and grey mould of pears (*Botrytis cinerea*) [ibid., 23, p. 28], using punctured, inoculated fruits, sodium chlororthophenylphenate, either in a rinse or in an alkaline wash, proved to be the most effective against *P. expansum* and *B. cinerea*, the incidence of which was reduced by 80 to 95 per cent. The thiocarbamates were ineffectual against blue mould, but the soluble salts gave excellent control of *B. cinerea*. *N. perennans* withstood treatment both by the phenol derivatives and thiocarbamates, but yielded to alkyl dimethyl benzyl ammonium chloride either in a final rinse or in an acid wash. Except for several mercury compounds, none of the other fungicides tested was equal to sodium chlororthophenylphenate for the elimination of the blue and grey moulds. In semi-commercial tests on apples this compound in a final rinse reduced the amount of decay by 43 to 75 per cent., while in similar experiments on pears a reduction of 65 to 86 per cent. was effected by the addition of chlororthophenylphenate either to a final rinse or to an alkaline wash.

Drummond Gonçalves (R.). **Tratamento contra as doenças mais comuns da Pereira, Macieira e Marmeleiro.** [Treatment against the most common Pear, Apple, and Quince diseases.]—*Biológico*, 14, 5, p. 119, 1948.

Control measures against widespread diseases of apple, pear, and quince in São Paulo, Brazil, notably black rot [*Physalospora obtusa*] and bitter rot [*Glomerella cingulata*], are briefly discussed.

Thornberry (H. H.), Eisenstark (A.), & Anderson (H. W.). **Studies on the bacteriophage of Xanthomonas pruni.**—*Phytopathology*, 38, 11, pp. 907–911, 2 figs., 1948.

The present studies on the bacteriophage of *Xanthomonas pruni* were undertaken to expand the knowledge of this bacterial virus in the light of the methods,

equipment, and concepts developed since its original isolation in 1927 [*R.A.M.*, 7, p. 432]. The bacteriophage was found to have remained viable for 20 years in sealed tubes at room temperature in darkness. Its titre has been increased by shallow broth culture, which permitted dense growth of the bacteria, from 10^{-5} to 10^{-9}. The bacteriophage is specific for *X. pruni*. The particles revealed by electron microscopy and presumed to be those of the bacteriophage are about 50 mμ in diameter. Some of them appear to be provided with appendages, measuring about 100 by 10 mμ and resembling the *Escherichia* [*Bacterium*] *coli* bacteriophage particles.

Calavan (E. C.) & Keitt (G. W.). **Blossom and spur blight (Sclerotinia laxa) of sour Cherry.**—*Phytopathology*, 38, 11, pp. 857–882, 4 figs., 1 graph, 1948.

A comparative study was made of numerous isolates of *Sclerotinia laxa* from sour cherry in Door County, Wisconsin [*R.A.M.*, 23, p. 234], and collections from various hosts in the Pacific Coast States of California, Oregon, and Washington. General features of the colonies on potato dextrose agar and other nutrient media included marginal lobing, zonation, and scanty conidial production. Conidia developed in most isolates on Emperor grapes within three days at 16° to 24° C., or on potato dextrose agar within two months at 4° to 8°. They germinated readily at 16° to 32° and germination occurred at 4° and 34·5°, but not at 37°. A minimum period of two hours was required for germination. In the presence of sufficient nutrients the germ-tubes were crooked and branched. The optimum temperature for radial growth in culture was about 28°, some occurring at 4° and 32°, but none at 37°. In potted sour cherry trees in the greenhouse infection and blighting of inoculated blossoms were most rapid at 24° but also took place at 5° and 30°. A temperature of 11° was more conducive to spur blight development than 16° or upwards.

Most blossom infections originated either through the stigmas or through the anthers, though the petals or other blossom parts were occasionally attacked. The filaments and sepals contracted infection only through wounds or after contact with rotted tissue. Blossom-time was established as the critical period for infection, though under experimental conditions unopened, white-tipped buds were frequently invaded. Specially favourable conditions in the greenhouse and orchard sometimes led to the infection of green fruits and leaves. No significant difference in susceptibility between the Early Richmond and Montmorency varieties was apparent in the greenhouse, though the former had been observed to suffer much more severely from spur blight in the orchard.

A note on the results of the eradicant and blossom-spraying experiments against *S. laxa* in 1942 and 1943 has already appeared [ibid., 24, p. 197]. In 1944 there was very little spur or blossom blight owing to the dry weather during the critical period, but as in the previous year the dormant spray and a supplementary bloom application gave the best control (92 per cent.). It is recommended that the former, consisting of copper-lime-monocalcium arsenite, 3–2–2–50 plus 1½ pints fish oil, be applied shortly before bud-break, and the latter (Bordeaux mixture, 3–4–50) soon after the blossoms have begun to open.

Zeller (S. M.) & Milbrath (J. A.). **Western X-disease of Montmorency Cherry and its relation to buckskin of sweet Cherry.**—Abs. in *Phytopathology*, 38, 11, p. 920, 1948.

Montmorency cherry trees infected by 'little cherry' [*R.A.M.*, 27, pp. 354, 555; 28, p. 69] bear small green fruits that ripen late. Transmitted to sweet cherry, the 'little cherry' inoculum causes buckskin disease [peach X-disease virus: see next abstract], while peaches react with western X-disease [? a strain of peach X-disease virus] symptoms. A table of 54 cross-transmissions of western peach X-disease virus, red-leaved chokecherry [*Prunus virginiana* var. *demissa*] disease, and the 'little cherry' found in the Montmorency and several sweet cherry varieties in Wasco

country, Oregon, indicates that all these disorders are caused by the same virus, or that the infected trees harbour the western peach X-disease virus. The symptoms of this disease in sweet cherry present the same appearance as those of buckskin of the same host in California [ibid., 25, p. 37]. On the other hand, the Oregon virus has not been demonstrated to occur in mazzard cherry and Mahaleb [*P. mahaleb*] rootstocks, as reported for buckskin disease of cherry in California.

Simonds (A. O.). **Apricots and Plums as hosts of western X-disease.**—*Science*, 109, 2826, p. 199, 1949.

Since Bodine's report in 1944 on the western X-disease virus [? a strain of peach X-disease virus] in Colorado, where it was estimated that 100 peach trees were involved in the absence of the natural carrier, *Prunus virginiana* (*Plant Dis. Reptr*, 28, p. 780) [and cf. preceding abstract], infection has continued to spread, and the existence of other hosts was therefore postulated. To verify this hypothesis, several varieties of apricot nursery trees growing on apricot seedling rootstocks and plums growing on peach rootstocks were inoculated in the summer of 1946 with buds from western X-diseased peach trees. In 1947 buds taken from the inoculated trees were inserted in small Elberta peach trees. The development of western X-disease symptoms in the latter in 1948 showed that two apricot varieties, Jones and Early Horn, and two of plum, Big Mack and Duarte-Satsuma, can carry the virus, none of the 40 uninoculated checks being affected. All previously inoculated apricot and plum trees were reinoculated from peach in 1947, and at the time of writing the Climax plum showed premature yellowing and bronzing of the foliage suggestive of western X-disease infection. Further studies are in progress.

Moore (J. D.), Boyle (J. S.), & Keitt (G. W.). **Mechanical transmission of a virus disease to Cucumber from sour Cherry.**—*Science*, 108, 2814, pp. 623–624, 1948.

In greenhouse studies at the University of Wisconsin in 1947 young cucumber plants were mechanically infected by a virus from eight cherry trees affected by both the necrotic ring-spot and cherry yellows viruses [*R.A.M.*, 28, pp. 20, 178] and from one harbouring the former but not the latter. Transmission was effected by grinding very young cherry leaves in the incipient phase of necrotic ring spot and rubbing the undiluted expressed juice on the cucumber cotyledons. Similar attempts to transmit the disease from older cherry leaves were unsuccessful.

From two to four days after inoculation small, yellow rings appeared on the cotyledons of cucumber plants held at 20° to 28° C., and soon expanded into yellow blotches coalescing to form a well-defined mottle. The infected cotyledons usually persisted as turgid functional organs for many weeks, in contrast to those of normal plants, which soon turned brown and withered. Within 24 to 48 hours after the development of symptoms on the cotyledons, yellow spots began to appear on the unfolding leaves, beginning at the base of the plant, and were usually followed by the formation of yellow rings, mottling, and crinkling of the affected foliage, and occasionally by the death of the primary leaves. The apical growing point was very quickly destroyed, and about 30 to 45 days after inoculation, bud proliferation, without elongation, was observed in its axil. Many flowers and dwarfed leaves developed in a very compact rosette. A few of these badly rosetted plants put out weak, spindly shoots after a protracted period at high temperatures in the greenhouse.

In the late season of 1948 six cherry trees were inoculated by placing under the bark small pieces of cucumber leaf from a plant infected from a cherry harbouring both the necrotic ring spot and yellows viruses. One of the inoculated trees developed definite necrotic ring spot symptoms, which also appeared on one of three cherry trees inoculated at the same time with leaf tissue from sour cherry with necrotic ring spot, while the three controls remained healthy.

Final conclusions as to the identity of the virus or viruses inducing the disease on cucumber have not yet been reached, but the evidence so far available strongly suggests the necrotic ring spot virus as the agent. Owing to the long incubation period for yellows, the cherry trees inoculated from cucumber cannot be examined for possible symptoms of that disease until 1949. This is believed to be the first mechanical transmission of a stone fruit virus disease and the first transmission of a sour cherry virus to a herbaceous host.

Turner (W. F.). **Insect vectors of phony Peach disease.**—*Science*, 109, 2822, pp. 87–88, 1949.

Phony peach virus disease [*R.A.M.*, 21, p. 378] is most serious and prevalent in the commercial orchards of the Atlantic and Gulf Coast States from South Carolina to Louisiana. During the period from 1929 to 1947, inclusive, it has caused the loss of over 1,500,000 trees. Since 1936 the Bureau of Entomology and Plant Quarantine, in co-operation with the Bureau of Plant Industry, has been conducting a survey to determine the insect vectors of the disease, and evidence is now forthcoming to the effect that four species of stem-feeding leafhoppers (Cicadellidae, subfamily Tettigellinae) may serve in this capacity. The virus has a long incubation period, ranging from 18 months to three years, and it was not until 1948 that reliable diagnoses could be made of symptoms resulting from the 1945 and 1946 inoculations in Fort Valley, Georgia. Out of a total of 203 transmissions, *Homalodisca triquetra* was definitely implicated in eight and probably in another eight, the corresponding figures for 64 tests with *Cuerna costalis*, 26 with *Oncometopia undata*, and 20 with *Graphocephala versuta* being one and two, three and none, and two and none, respectively. The definitely positive results represent 2 to 28 per cent. successful transmission by the different species.

Bertelli (J. C.). **Histopatología de las lesiones gomosas del Duraznero (Prunus persica Sieb. et Zucc.).** [Histopathology of the gummous lesions of the Peach (*Prunus persica* Sieb. & Zucc.).]—*Rev. Asoc. Ing. Agron.*, 20, 82, pp. 9–34, 8 figs., 1948. [English summary.]

This is a full description of the writer's continued studies on the histopathology of the gummous lesions developing on peach trees in Uruguay as a sequel to infection by *Phomopsis* sp., *Ascospora beijerinckii* [*Clasterosporium carpophilum*], *Cladosporium carpophilum*, or damage by other agents (cf. *Rev. Asoc. Ing. Agron.*, *1942*, 3, 1942; *1947*, 78, 1947). It is concluded that the gummosis represents the normal defensive reaction of the host to the stimulus of the mechanical, climatic, toxic, parasitic, or infectious agency, and that its effective control must be based on a knowledge of the cause.

Wenzl (H.). **Die Grenzen der therapeutischen Sommerbekämpfung des amerikanischen Stachelbeermeltaus.** [The limitations of the therapeutic summer treatment of the American Gooseberry mildew.]—*PflSch. Ber., Wien*, 3, 1–2, pp. 10–16, 1949. [English summary.]

Tests at Höflein on the Danube, Austria, in 1948 demonstrated the effective control of American gooseberry mildew [*Sphaerotheca mors-uvae*] on the susceptible Red Greifenstein variety by thorough spraying with 1 per cent. formalin or 0·5 per cent. calcined soda, with the addition in each case of 0·2 per cent. sandovit. The treatments were applied on 4th May, when the fruits were almost entirely covered with the mildew, which made its first appearance on 25th April, almost immediately after flowering. At harvesting there was no trace of the disease. No additional benefit accrued from a second application on 10th May. In the extremely dry seasons of 1947 and 1948 Bordeaux mixture gave a distinct measure of control,

which could not, however, be rated as sufficient [cf. *R.A.M.*, 25, p. 171]. Copper-containing fungicides tend to leave a deposit which imparts a disagreeable, bitter flavour to the fruit. In order to avoid this development, which is most noticeable in dry weather and in regions with a low rainfall, the copper content of the sprays should be reduced to 0·75 or even to 0·5 per cent. and no further treatments should be given after the berries have reached pea size.

Wilhelm (S.), Thomas (H. E.), & Jensen (D. D.). **A dwarfing virus disease of Bramble fruits.**—Abs. in *Phytopathology*, 38, 11, p. 919, 1948.

Logan blackberries affected by a serious graft-transmissible virus disease in California are characterized by marked dwarfing of cane growth, poor fruit lateral development, downward cupping and yellow-bronze coloration of the leaves, premature autumn reddening, and precocious formation of basal buds, giving the plants a bunchy-top appearance late in the season. Growth starts late in the spring, and after a year or more the diseased plants are unproductive. The blackberry varieties and species genetically related to the Logan, viz., Mammoth, Cory's Thornless, and Phenomenal, and the Pacific Coast trailing blackberry (*Rubus ursinus*) are readily graft-inoculated and all but the last severely attacked. Milder symptoms develop in the Boysen, Young, and Nectar varieties following inoculation, but the disease has not been observed on them in the field. In 5 out of 35 tests the disease developed in Logan when inarched to *R. ursinus*, indicating that this wild blackberry harbours the dwarfing virus.

Plakidas (A. G.). **Strains of Mycosphaerella fragariae.**—*Phytopathology*, 38, 12, pp. 988–992, 1948.

An account is given of inoculation tests carried out at the Cornell (New York) and Louisiana Agricultural Experiment Stations to confirm the evidence of many years' observations as to the existence of distinct strains of *Mycosphaerella fragariae* varying in their pathogenicity to different strawberry varieties. Seven isolates were used, of which three, S3, S18, and S1610, were collected on Klondike plants in Louisiana; two, S83 and S1600, on seedlings at Corvallis, Oregon, and Geneva, New York, respectively; one, S1388, on dead wild strawberry (*Fragaria virginiana*) at East Lansing, Michigan; while one, S1502, was an ascospore culture from Beltsville, Maryland. The potted plants (of ten varieties, two plants for each isolate) were sprayed with conidial suspensions from bean pod and potato dextrose agar cultures and immediately transferred for three days to a moist chamber of saturated humidity, in which the temperature was maintained at 75° to 80° F. The lesions generally began to appear between the 12th and the 15th day after inoculation, and final records were taken at the end of 28 days.

The resultant data gave definite indications that *M. fragariae* is composed of strains of varying pathogenicity. The reactions of the supposedly susceptible Clermont variety were of particular interest, since it proved resistant to five of the strains but was heavily attacked by S1502 and S1600. A similar response was exhibited by U.S.D.A. Seedling No. 1942, which was more or less resistant to five strains, including S1502, but susceptible to S1600 and S1610. S83 was the least pathogenic of all the strains except to the Caledonia variety, which it attacked with great severity.

In the field the Klonmore variety, a cross between Klondike and the resistant Blakemore, generally remains free from leaf spot, but under the experimental conditions described it proved highly susceptible. The nature of the factor or factors governing resistance to *M. fragariae* in Klonmore is unknown, but it may be connected with the upright growth habit of the plants, which aids in the rapid drying of the leaf surfaces. It has been shown that under conditions of low atmospheric humidity the fungus may cause infection but remain dormant in the tissue

without producing external symptoms [*R.A.M.*, 13, p. 713]. In any case the behaviour of this variety affords a striking example of the discrepancy between the results of inoculation and natural infection. Had the former been used as a criterion, the leading commercial variety in Louisiana, occupying some 80 per cent. of the total strawberry acreage, would have been lost.

The reaction of Dresden is probably analogous to that of Klonmore. Completely resistant in the field, at Geneva it proved susceptible in the inoculation tests to all the strains including S1600. Howard 17 and U.S.D.A. seedling No. 1021 showed a degree of resistance approaching immunity both in the field and under experimental conditions, but the few lesions that did develop were typical.

Regardless of the mechanism controlling their reactions, the test varieties may be grouped as follows: (I) comprising those resistant both to natural and artificial infection, such as Howard 17 and U.S.D.A. Seedling No. 1021; (II) field resistant but very susceptible to inoculation, e.g., Klonmore and Dresden; and (III) susceptible both to natural and artificial infection, exemplified by Klondike, Caledonia, and Marshall.

Burton (M. O.). **Mould contamination on Strawberry hallocks.**—*Canad. Food. Industr.*, 19, 12, p. 27, 1948.

In an investigation at Summerland, British Columbia, to obtain comparable mould counts from new and used strawberry hallocks (packing-boxes), six square-inch pieces were cut from each box and placed in a sterile Waring blendor with 200 ml. sterile water. After four minutes the liquid was placed on malt agar at pH 3·5, in duplicate, in quantities of 1 ml., 1/10 ml., 1/100 ml., and 1/1,000 ml., and counts were made after five days' incubation at room temperature. The average spore counts per sq. in. were as follows: samples showing no visible discoloration (new, unused boxes), 10,211; visible contamination represented by +, 21,408; ++, 35,471; +++, 133,208; and ++++, 1,591,725.

Condit (I. J.). **The Fig.**—xvii+222 pp., 21 figs., 1 graph, 4 maps, Waltham, Mass., The Chronica Botanica Co., London, William Dawson & Sons, Ltd., 1948. $5.00.

In the preparation of this valuable and comprehensive monograph on the fig, to which a foreword is contributed by W. T. Swingle, the author had two purposes in mind. The first was to assemble in one volume the essential information on the subject, hitherto available only in scientific periodicals and books, and the second to share with all those interested the results of his studies and research in California during the last 30 years. There are 20 chapters, of which chapter XIX deals with diseases, which are discussed under the subheadings root diseases, trunk and branch diseases, leaf diseases, and fruit diseases, brief notes being given on the various diseases with references to the literature. A 19-page bibliography is appended.

Ruggieri (G.). **Ricerche ed esperienze su una tracheoverticillosi dell' Olivo.** [Researches and experiments on a tracheoverticilliosis of Olive.]—*Olivicoltura*, 3, 10, pp. 6–9, 1948.

Further studies on olive tracheoverticilliosis (*Verticillium albo-atrum*) [*R.A.M.*, 27, p. 317] in Sicily showed that the disease is also present in irrigated areas remote from the district where it was originally found; the olives frequently are growing in close proximity to market-garden crops susceptible to attack by the same fungus. The disease has not been found in olives cultivated in non-irrigated conditions. Young trees are most commonly attacked, probably because the roots are more easily reached by the fungus passing through the soil from those of market-garden crops than are the deeper roots of fully grown trees. In one case infection was found to be confined to the crown, and after removal of the affected branches the

tree showed no further symptoms. All local olive varieties appear to be equally susceptible, as well as some imported varieties. The disease is not, however, of much economic importance at present.

In 1946 wound inoculations were made, using strains of the fungus from the first three olive trees found to be affected [loc. cit.], on healthy young olive plants in pots and others growing in the open. Two and a half months later, though no external symptoms of the disease were apparent, two branches showed characteristic discoloration of the woody cylinder, and the fungus was found 50 cm. away from the inoculation site. Between spring and summer, 1947, the leaves on the top branches of the inoculated plants turned pale. Between the end of the summer and early October some of the affected branches gradually became defoliated from the base to the tip. Characteristic symptoms were manifest in the woody cylinder up to more than 1 m. above the inoculation site, and up to 15 cm. below it. In these branches mycelium was found not only in the annual ring formed in 1946, but also in the current year's. Thus, an olive tree may develop external symptoms of the disease several years after infection has taken place.

Hypodermic inoculations into olive trees and seedlings, made with four different strains of the fungus from eggplant, chilli, tomato, and potato, respectively, produced no external symptoms after four months, though internally the mycelium had reached an average distance of 90 cm. above and 10 cm. below the point of inoculation, all the strains reacting similarly.

These results show that the disease progresses very slowly in olive trees, which, however, do not display any marked recuperative power. Pruning would not appear to offer an effective means of control unless infection were very superficial. Olives should not be grown in proximity to other susceptible hosts.

Biraghi (A.) & Naldi (L.). **Ulteriori notizie sul deperimento progressivo dell' Olivo.** [Further notes on the progressive decline of the Olive.]—*Olivicoltura*, 3, 10, pp. 3–5, 1948.

Further studies on the progressive decline of olives reported from Italy in 1938 [*R.A.M.*, 18, p. 537] showed that the crowns of the affected trees are completely or partially defoliated. A small tuft of leaves persists at the extremity of the otherwise leafless branches. Before defoliation occurs, the adult leaves all show a chlorotic area spreading towards the middle but which terminates abruptly, the colour of the part of the leaf beyond remaining normal. Branches so affected do not fruit, though healthy ones on the same tree give a normal yield. In addition to phloem necrosis in affected stems, the sclerenchymatous bundles contained abnormally few elements; in some cases no fibres were formed. These reduced groups of bundles tended to approach the cambium and were occasionally found in contact with it.

The disease may start on one tree or a few trees in a grove and gradually spreads from the original centre of infection. Up to 1946 affected trees survived for some years, but since then, in two young, carefully tended groves, death has supervened in two or three years. Heavy rains in 1948 appreciably diminished the outward manifestations of the disease. Experiments are in progress to determine whether the condition is of virus origin, and work on the selection of resistant varieties has begun.

Ciferri (R.). **Infectious chlorosis of Bananas in Colombia.**—*Nature, Lond.*, 163, 4135, p. 175, 1949.

A virus disease, probably identical or closely allied to the infectious chlorosis or heart rot of bananas [? strain of cucumber mosaic virus], has recently been found in the Cauca Valley, on the Pacific side of Colombia, and is being studied by the staff of the Agricultural Experiment Station, Palmira. This is a new record of the

disease, which has already been reported from Guadeloupe [*R.A.M.*, 17, p. 191], Haiti [ibid., 18, p. 327], Australia, and Africa [ibid., 28, p. 130]. The symptoms are like those already described with the exception of linear spots (from midrib to margin) which are frequently brown or reddish, instead of chlorotic. This feature appears to be correlated with the presence of anthocyanin pigment in the leaves.

Wiant (J. S.) & Bratley (C. O.). **Spoilage of fresh fruits and vegetables in rail shipments unloaded at New York City, 1935-1942.**—*Circ. U.S. Dep. Agric.* 773, 62 pp., 1948.

This is a summary of the records of decay entered on 117,613 inspection certificates of car-lot rail unloads, issued at New York City by the Fruit and Vegetable Branch, Production and Marketing Administration, United States Department of Agriculture, during the seven-year period from July 31, 1935 to August 1, 1942. With certain specified exceptions the car-lots inspected were representative of all rail unloads during that period. The certificates covered the inspection of 14 different types of fruit (an average of 14·3 per cent. of rail unloads), and 31 vegetables (average 36·1 per cent.). By multiplying the number of car-lots inspected for each commodity by the average decay recorded it was determined that decay among fruits totalled 391 car-lots (average 2·1 per cent. decay per car-lot), and among vegetables 5,320 car-lots (average 3·8 per cent. per car-lot). Of all decay reported on the fruits, 30 per cent. was due to blue mould (*Penicillium* spp.) rot, 25 per cent. to grey mould (*Botrytis* spp.) rot, 15 per cent. to rot caused by *Rhizopus* spp. and 3 per cent. to *Cladosporium* spp. The remaining 27 per cent. of fruit spoilage was due to five other types of decay and four non-parasitic disorders. Of all the decay reported for vegetables, 36 per cent. was due to bacterial soft rot (*Erwinia carotovora* and *E. aroideae*), 3 per cent. to watery soft rot (*Sclerotinia* sp.), 2 per cent. to *Rhizopus* rot, and 1 per cent. to grey mould rot. The remaining 58 per cent. was caused by 27 other types of decay and five non-parasitic disorders. It is reasonable to assume that decay in the car-lots not inspected was as great as in those inspected. It was calculated that decay in all rail shipments of the 14 fruits totalled 4,936 car-lots and that of the 31 vegetables, 15,689 car-lots. These figures, however, give no account of the decay occurring in truck or boat shipments. On the basis of these figures, decay of the 45 commodities during rail transit to New York City totalled annually nearly 3,000 car-lots.

Culler (Dorothy), Weiser (H.), & Witman (E. D.). **Effect of 2, 4-dichlorophenoxyacetic acid upon the morphological and physiological characteristics of certain microorganisms associated with food spoilage.**—*Food Res.*, 13, 6, pp. 482–490, 1948.

The concentrations of 2,4-dichlorophenoxyacetic acid [*R.A.M.*, 27, p. 562 and below, p. 237] required to inhibit the growth of *Erwinia carotovora*, *Phytomonas* [*Xanthomonas*] *stewarti*, *P.* [*Pseudomonas*] *tabacum*, *Phytomonas* [*Bacterium*] *tumefaciens*, *P.* [*Corynebacterium*] *fascians*, *P.* [*Xanthomonas*] *phaseoli*, and *E. phytophthora* in nutrient agar cultures were over 12,000, 1,000, 2,000, 1,000, 1,000, 2,000 and 12,000 p.p.m., respectively. The concentrations necessary to inhibit the development of some fungal pathogens were as follows: *Colletotrichum phomoides*, *Penicillium expansum*, *P.* sp. from soy-bean seedlings, *Phycomyces nitens*, and *Sclerotinia sclerotiorum* 40,000 p.p.m.; *Helminthosporium turcicum* 20,000; and *Phytophthora cactorum*, *Glomerella cingulata*, *S. cinerea*, *Sclerotium rolfsii*, and *S. delphinii* 10,000. From these data it is concluded that the amounts of 2, 4-dichlorophenoxyacetic acid requisite for the control of spoilage by those organisms are too high to be of practical interest in the case of the fungi and the two

species of *Erwinia*, but infection by the other bacterial pathogens might be prevented by its use at reasonably low concentrations.

The growth-regulator exerted no influence on the rates of spoilage or ripening of oranges, but both processes were accelerated by its application to bananas and apples, while pear spoilage was also increased.

CHRISTENSEN (C. M.), STAKMAN (E. C.), & CHRISTENSEN (J. J.). **Variation in phytopathogenic fungi.**—*Ann. Rev. Microbiol.*, 1, pp. 61–84, 1947. [Received January, 1949.]

After pointing out that an analysis of the biotypes that comprise a species is a fundamental prerequisite to an understanding of the different types of variability and variation, the authors briefly review and discuss the subject of variation in phytopathogenic fungi with numerous references to the relevant literature. The main headings under which the subject is dealt with are composition of species, phenotypic variability, semi-permanent modifications, mutation, heterocaryosis, hybridization, evidence of variation in nature, and the practical importance of variation in phytopathogenic fungi. A list of 137 references is appended.

HWANG (S. W.). **Variability and perithecium production in a homothallic form of the fungus, Hypomyces solani.**—*Farlowia*, 3, 3, pp. 315–326, 3 diags., 1948.

Using the monospore culture method, the author made an analysis of the variability of a homothallic form of *Hypomyces solani* [cf. *R.A.M.*, 26, p. 162], isolated from the stem of banana imported into California from Mexico. This homothallic isolate, apparently saprophytic on the banana, is the perfect state of *Fusarium solani*, which contains both saprophytic and parasitic forms. Two principal variants developed, the B or button and E or end types. The prominent characteristics of B were its slow growth rate on potato dextrose agar and the general creamy appearance of the raised colony, which was very suggestive of a yeast. The cultural characters of E were those commonly associated with *Fusarium*, the mycelial mats being thicker than those of the normal (N) type. The variants arising in monoconidial and monoascospore cultures were predictable and occurred with high frequency, always in the sequence N to B to E, or B to B1 to E1. B1, a variant of B, produced an extraordinary abundance of macrospores and perithecia, while its derivative, E1, formed microconidia in profusion. No reversions in type occurred. Since all the variants were passed unchanged through the sexual stage and a cross between N and E has been successfully accomplished, the variations in *H. solani* herein described are attributed to gene mutations or deletions.

Light was shown to be one of the factors essential for the initiation and maturation of perithecia. The incidence of variation in E remained constant in tests under different environmental conditions and at ages from one to four months, whereas it declined in B and increased in N.

ALKIEWICZ (J.). **Technika badań morfologicznych i biochemicznych drożdżowców chorobotwórczych.** [Technique of the morphological and biochemical examination of yeast and yeast-like fungi.]—Reprinted from *Pol. Tyg. Lek.*, 1, 17 pp., 1946. [Received 1949.]

In the first part of this paper the author, who is Reader in Medicine at the University of Poznań, describes cultural methods and media, microculture and hanging drop methods, and staining techniques for yeasts and yeast-like fungi. The second part comprises the biochemical technique, including auxanography with carbohydrates and proteins, fermentation tests, and the technique of purifying cultures.

Allison (A. C.) & Chacko (L.). **The use of a camera lucida for micrometry and counts of nerve fibres and other small objects.**—*J. R. micr. Soc.*, Ser. III, 69, 1, pp. 18–19, 2 figs., 1949.

A method has been devised by which measurements of the diameter of very small fibres or similar small objects can be made. A large scale, with lines the thickness of which are graded according to the objects to be measured, is reduced photographically, and the lines measured accurately under low power. It is then calibrated under the camera lucida by marking the position of the stage micrometer divisions as seen with an oil-immersion objective. In use the image of the end of one of the lines is matched against the object to be measured. In this way it is possible to estimate, with a fair degree of accuracy, the size of objects as small as 0·2 μ.

In estimating numbers a square subdivided into smaller squares may be used at the same time in order to divide the microscopical field into sections. The number of objects in each small square can be counted directly, if their number is sufficiently small, or the position of each lightly marked in pencil and the marks counted later.

Plakidas (A. G.). **A convenient method for isolating slow-growing pathogenic fungi from plant tissues.**—*Phytopathology*, 38, 11, pp. 929–931, 1948.

The method described by Bitancourt for the isolation of sweet orange scab (*Elsinoe australis*) [*R.A.M.*, 19, p. 339] has been modified by the writer in his studies on *Sphaceloma* scab of *Camellia* as follows. The tissue sections were placed on hanging drops of agar on cover slips suspended on glass rings in a moist chamber instead of on slides, thereby providing a separate sealed chamber for each drop and partially eliminating the risk of contamination. Seven or eight holes are cut in two layers of filter-paper of a size to fit the bottom of a 15-mm. Petri dish. Glass rings are placed over the holes and cover slips on the glass rings. The dishes thus prepared are sterilized dry in an autoclave and, after cooling, drops of melted agar are placed on the cover slips and enough sterile water poured into the dish to wet the filter-paper. Carrot agar is the medium commonly used, but potato dextrose and oatmeal agars have also given satisfactory results. A tissue section can be examined with the microscope through the glass cover slip for as long as seems necessary without risk of contamination from the air. Other slow-growing fungi successfully isolated by this procedure were *S.* sp. on Chinese holly, *E. veneta* on dewberry, and *Diplocarpon earliana* and *Mycosphaerella fragariae* on strawberry.

Fennell (Dorothy I.), Raper (K. B.), & Flickinger (May H.). **Further investigations on the preservation of mould cultures.**—Abs. in *Amer. J. Bot.*, 35, 10, p. 800, 1948.

Observations and tests at Peoria, Illinois, extending over a period of seven years, continue to indicate that the lyophile process [*R.A.M.*, 26, p. 408] provides an optimum means of maintaining cultures of those saprophytic moulds which produce aerial spores. Viability tests covering a large variety of moulds reported in 1945 on cultures stored for approximately two and three and a half years have since been repeated at five and seven years, respectively, without substantial reductions in measurable viability. In comparing different methods of preservation for 250 members of the Mucorales, representing more than 60 species in 14 genera, kept for two to two and a half years at 4° C., all strains grew from the lyophile preparations, but 14 soil cultures, 49 oil-sealed cultures, and 74 malt agar slants failed to grow. A general correlation between species identity and viability was observed.

Wernham (C. C.) & Miller (H. J.). **Longevity of fungus cultures under mineral oil.**—*Phytopathology*, 38, 11, pp. 932–934, 1948.

On 15th March, 1948, four years after treatment with mineral oil as already

described (*Mycologia*, 38, pp. 691–692, 1946) [cf. *R.A.M.*, 27, p. 329], four maize pathogens, viz., *Diplodia zeae*, *Gibberella zeae*, *Helminthosporium maydis*, and *Nigrospora oryzae*, were transferred to potato dextrose agar. The culture of *D. zeae* yielded good cultures after nine days and the others made luxuriant growth in three days. During the previous season *D. zeae*, *G. zeae*, and *H. maydis* had been tested and found actively pathogenic after three years under oil.

Of 45 cultures of *Phytophthora infestans* on Lima bean agar treated with mineral oil and held at 12° C., only two were non-viable after a year. Of the remaining 43, 28 were subcultured and kept under mineral oil for a further year, together with the original 28. Twenty of the two-year cultures and all the one-year subcultures survived, and the former retained their pathogenicity, though diminished, in greenhouse tests on potatoes. *Sclerotinia fructicola* and *Venturia inaequalis* have also been kept satisfactorily under oil for two years without transfer, but pathogenicity tests were not made.

Brooks (F. T.). **Fungi and their economic importance.**—*Advanc. Sci.*, 5, 20, pp. 329–334, 1949.

In this paper, delivered as a lecture on 7th October, 1948, the author discusses, with illustrative examples, the deterioration of food and fabrics caused by fungi, the use of fungi (e.g., yeasts) in food and drinks, in the production of penicillin and other antibiotics and citric acid, bio-assay, ergot (*Claviceps purpurea*), fungi as human food, mycorrhiza, fungi in the causation of plant diseases, and the control of such diseases by the development of resistant varieties, fungicidal treatments, and improved cultural methods.

Hanna (G. D.). **A synthetic resin which has unusual properties.**—*J. R. micr. Soc.*, Ser. III, 69, 1, pp. 25–28, 1949.

The preparation, properties, and use of a lemon-yellow synthetic resin named pleurax made from 40 gm. powdered sulphur, 100 gm. crystalline phenol, and 2 gm. anhydrous sodium sulphide are described. It adheres tenaciously to glass and is completely soluble in 95 per cent. ethyl alcohol and in acetone, giving a thick fluid resin suitable for mounting purposes. Isopropyl alcohol appears to be an even better solvent. Pleurax has an exceedingly high index of refraction and the dispersion is not excessive. The total solubility in ethyl alcohol might be expected to make it feasible to eliminate the usual 'clearing' of tissue sections entirely.

Benedict (R. G.) & Langlykke (A. F.). **Antibiotics.**—*Ann. Rev. Microbiol.*, 1, pp. 193–236, 1947. [Received January, 1949.]

The authors review and discuss, with numerous bibliographical references, the most recent developments up to the time of writing in the study of antibiotics. The subject is treated under the main headings of antibiotics from bacteria, Actinomycetes and related forms, yeasts, and moulds, the antibiotic activity of Phycomycetes, antibiotics from Basidiomycetes, algae, lichens, and higher plants, and the mechanism of the action of antibiotics. A bibliography of 210 titles is appended.

Leben (C.) & Keitt (G. W.). **An antibiotic substance active against certain phytopathogens.**—*Phytopathology*, 38, 11, pp. 899–906, 1 fig., 1948.

Antimycin is the name tentatively applied to the antibiotic from an unidentified species of *Streptomyces*, preliminary notes on which have already appeared [*R.A.M.*, 27, p. 284]. The antagonism of the substance has now been demonstrated *in vitro* in relation to 33 fungi, mostly phytopathogenic, and including, besides those

previously mentioned, *Ascochyta* sp. from peas, *Chalara quercina*, *Colletotrichum circinans*, *C. graminicola*, *C. lagenarium*, *C. lindemuthianum*, *C. phomoides*, *C. pisi*, *Fusarium oxysporum* f. *conglutinans* [*F. conglutinans*], *F.o.* f. *lycopersici* [*F. bulbigenum* var. *lycopersici*], *F.o.* f. [var.] *nicotianae*, *F.o.* f. [var.] *pisi*, *Gibberella zeae*, *Helminthosporium sativum*, *Mycosphaerella citrullina*, *Nigrospora sphaerica*, *Ophiobolus miyabeanus*, *Phoma lingam*, *P. terrestris*, *Pythium graminicola*, *Sclerotinia minor*, *S. sclerotiorum*, and *Stemphylium sarciniforme*. The development of *Erwinia amylovora* was also inhibited by antimycin, but nearly all the other bacteria tested were unaffected. The most sensitive of the fungi, *N. sphaerica*, was completely suppressed at a concentration of 0·2 μgm. per ml., whereas upwards of 250 μgm. was necessary to ensure comparable results with *F. oxysporum* var. *lycopersici*, *F.o.* var. *nicotianae*, and *F.o.* var. *pisi*.

Freeman (G. G.) & Morrison (R. I.). **The isolation and chemical properties of trichothecin, an antifungal substance from Trichothecium roseum Link.**—*Biochem. J.*, 44, 1, pp. 1–4, 1949.

The isolation of trichothecin from the culture filtrate of *Trichothecium roseum* [*R.A.M.*, 27, p. 437] is described. The anti-fungal compound was crystallized from light petroleum in long, fibrous needles, m.p. 118°. It was found to be relatively stable in acid solution and at pH 10, but at pH 12 hydrolysis took place.

Brian (P. W.), Curtis (P. J.), & Hemming (H. G.). **Gladiolic acid, an antibiotic substance produced by Penicillium gladioli McCull. & Thom.**—*J. gen. Microbiol.*, 2, 3, pp. 341–355, 5 graphs, 1948.

A more detailed study of the production and biological properties of gladiolic acid [*R.A.M.*, 25, p. 353] showed that this antibiotic is produced when *Penicillium gladioli* is grown on a wide range of media. The main factor affecting production and accumulation is the pH drift of the medium. High yields are associated with an initial fall to about pH 4 followed by a steady but not too rapid rise up to pH 6.

Though gladiolic acid is strongly fungistatic when tested at low pH, the toxic effect is due to the undissociated molecules only, and at pH 7, when dissociation is almost complete, it is almost inactive. At pH 3·5, the lowest concentration inhibiting spore germination varies from 0·9 μgm. per ml. for *Fusarium graminearum* [*Gibberella zeae*] to 250 μgm. per ml. for *Trichoderma viride*. Gram-positive and Gram-negative bacteria suspended in gladiolic acid solutions (100 μgm. per ml.) in buffer at pH 4 are rapidly killed.

Brian (P. W.). **Studies on the biological activity of griseofulvin.**—*Ann. Bot., Lond.*, N.S. 13, 49, pp. 59–77, 2 graphs, 1949.

Studies at the Butterwick Research Laboratories, Welwyn, showed that griseofulvin, a metabolic product of several species of *Penicillium* which is chemically and biologically identical with the product known as 'curling factor' [*R.A.M.*, 26, p. 462], profoundly influences the morphogenesis of many fungi. The effects producted by concentrations in the range 0·1 to 10 μgm. per. ml. include severe stunting, excessive branching, abnormal swelling and distortion of hyphae, and the production of spirally twisted hyphae. These effects were, however, not retained on transference to fresh media.

Of 51 fungal species examined all, except two yeasts and all the Saprolegniales and Peronosporales examined, were sensitive to griseofulvin. Bacteria and Actinomycetes were not affected. The depressing effect on the growth rate of *Botrytis allii* [ibid., 27, p. 83] was comparable in its dose response relationships to that produced by simple toxicants such as phenol. Other substances produced conspicuous stunting of *B. allii* germ-tubes in concentrations below those inhibiting germination, but

all induced a non-specific stunting ('cyclic acid stunting') distinct from that caused by griseofulvin. Among the most active was the mould product mycophenolic acid [ibid., 25, p. 175]. Griseofulvin was toxic to angiosperm seeds. The author adduces reasons for assuming that the effect of griseofulvin on sensitive fungi is exerted directly or indirectly on the cell wall or on its process of extension.

Eisenschiml (O.) & Kalberg (V. N.). **Fungiciding protective coatings.**—*Paint Varn. Prod. Mgr*, 28, 12, pp. 359–262, 1948.

An account is given of the development by the Scientific Oil Compounding Company, Chicago, of solubilized copper-8-quinolate [*R.A.M.*, 28, p. 24] (trade name 'cunilate'), which can be incorporated into lacquer, paint, synthetic enamel, and varnish at 15 or 20 per cent. (based on the weight of the vehicle solids) and confers effective protection against *Chaetomium globosum*, *Aspergillus terreus*, *A. niger*, and *Trichoderma viride*.

Stakman (E. C.), Daly (J. M.), Gattani (M. L.), & Wahl (I.). **Variation induced by uranium nitrate in Corn smut and the cultivated Mushroom.**—*Science*, 108, 2812, pp. 554–555, 1948.

In experiments at the University of Minnesota the addition of uranium nitrate to potato dextrose agar cultures at the rate of 0·5 to 1 gm. per l. has stimulated mutation and an unusual type of dissociation in the causal organism of maize smut, *Ustilago zeae* [*U. maydis*]. Both 17D4 and diploid line 410 qq. (the latter intermediate in cultured characters between its parents, the stable 10A4 and the rather unstable 17D4, but resembling the latter somewhat more closely) produced an exceptionally large number of mutants in the presence of 1 gm. uranium nitrate. Some of the mutants of 410 qq. were very similar to 17D4 and its mutants in cultural characters; they failed to cause infection when inoculated singly into maize plants but did so when combined with 10A4. Evidently, therefore, uranium nitrate induced reduction division or some other type of nuclear change resulting in the dissociation of the 17D4 factors for cultural characters, sex, and pathogenicity from their combination with those of 10A4. No lines were obtained with a close resemblance to the latter. In 17D4 and 410 qq. three to nine times as many mutants were formed in the presence of uranium nitrate as in its absence, the frequency depending on the line of smut, the concentration of the compound, and the temperature at which the cultures were maintained. The effect of uranium nitrate on the relatively stable 10A4 and 410n (diploid) was even more pronounced. The most remarkable facts about the 10 primary and 170 secondary mutants of 17D4 are that all the former grew better than the parent on uranium nitrate medium, that none of the 180 have lost any essential growth factors, and that some of them surpass 17D4 in such characters as colour and growth rate.

Studies with monosporous isolates of the common cultivated mushroom have yielded comparable results. Uranium nitrate and other uranium salts have given rise to mutants making five to seven times as much growth on artificial media as the original lines. The spawn of some mutants, moreover, has produced mushrooms earlier than the controls and white instead of brownish.

Yogeswari (Miss L.). **Trace element nutrition of fungi. I. The effect of boron, zinc and manganese on Fusarium species.**—*Proc. Indian Acad. Sci.*, Sect. B, 28, 6, pp. 177–201, 25 graphs, 1948.

Fusarium vasinfectum, *F. udum*, and *F. moniliforme* [*Gibberella fujikuroi*], isolated from wilt-sick cotton, pigeon pea, and rice soils, respectively, in the Coimbatore district of Madras, were found to be physiologically alike. All three species throve on Richards's medium, which has a high carbon-nitrogen ratio and proved superior

to the other solutions tested judging by the dry and ash weights of the mats after the requisite three weeks' incubation period. The fungi made good growth over a wide range of hydrogen-ion concentrations, with an optimum at pH 5. They all responded favourably to the enrichment of the medium with boron, zinc, and manganese, the optimum levels of which were as follows: *F. vasinfectum* 0·3 p.p.m. boron, 0·05 p.p.m. zinc, and 0·2 p.p.m. manganese; *F. udum* 0·5 p.p.m. of all three elements; and *G. fujikuroi* 0·3 p.p.m. of all. Higher concentrations were not toxic. The heaviest dry weights were secured in media containing boron, but zinc produced the maximum quantities of ash. Combinations of the micro-elements resulted in heavier weights than each one singly, boron plus manganese being the best for dry, and zinc plus manganese for ash in all three species. The dry and ash weights of the *F. vasinfectum* mats were heavier after 21 than after 42 days' growth. In this species both weights rose parallel with an increase in volume of the medium. The replenishment of cultures of *F. vasinfectum* with Richards's solution after the formation of stale products increased the dry and ash weights of the mats. Similar admixtures of micro-elements plus Richards's solution after 21 days' growth increased the dry and ash weights of the cultures over those where either the medium or the trace elements were used alone.

Dickinson (S.). **Studies in the physiology of obligate parasitism. 1. The stimuli determining the direction of growth of the germ-tubes of rust and mildew spores.** —*Ann. Bot., Lond.*, N.S., 13, 49, pp. 89–104, 1 diag., 1949.

In experimental studies at the School of Agriculture, Cambridge, it was found that the germ-tubes of rusts and powdery mildews grow sometimes along and sometimes away from the surface on which the spores have germinated. Even when precautions were taken to prevent humidity gradients, upright growth of the germ-tubes of *Erysiphe graminis* and *Puccinia triticina* was obtained from the surface of water, 2 per cent. gelatin medium, and pre-coloured (used before drying to the coloured stage) and high-alcohol-treated collodion membranes. The direction of growth was along the surface of post-coloured (not used until after colour appeared in the drying process) and low-alcohol-treated collodion membranes. In both cases growth was clearly affected by a stimulus, as the direction was rarely haphazard. The factor which affected the percentage of upright growth and the type of contact response was the condition of the membrane, as determined by the duration of drying or the alcohol concentration in which the membranes were treated.

The direction of growth of the germ-tubes of downy mildews is similar, except when germinated on water, when they grow under the surface. This difference is attributed to the fact that the spores of downy mildews are more readily wetted. On membranes the behaviour of *Peronospora schachtii*, *P. parasitica*, *Cladosporium fulvum*, and possibly *Verticillium dahliae* was similar to that of *Puccinia triticina* and *Erysiphe graminis* and in contrast to that of the other fungi tested. The condition of the gelatin membrane affected the percentage of upright growth in *Peronospora schachtii* more even than that of *Puccinia triticina* and *E. graminis*.

It is concluded that the tropisms controlling the direction of germ-tube growth are positive hydrotropism, negative thigmotropism, and dia-thigmotropism.

It is suggested that the artificial culture of these obligate parasites can be achieved only by altering the condition of the normal surface of the media; otherwise, growth would be away from the surface and no absorption of foodstuffs could occur. A suitable membrane should, therefore, be interposed between fungus and medium. This simulates the cell wall and cell contents of the host. The cell wall appears to influence the spread of parasites in infected tissues not merely as a physical barrier but as controlling the direction of hyphal growth through contact stimulation.

Appel (O.). **Kartoffelkrankheiten. I. Teil. Knollenkrankheiten. Vierte Auflage.** [Potato diseases. Part I. Tuber diseases. Fourth edition.]—39 pp., 24 col. pl., Berlin, Paul Parey, 1948.

This is the first of a series of pocket atlases (Pareys Taschenatlanten) under the editorship of Professor O. Appel. It contains the essential information on a number of well-known potato diseases, pests, and abnormalities occurring in Germany; an extract from the potato trading conditions regulating the quality of seed and table produce; and some general recommendations for storage.

Twenty-third descriptive list of varieties of field crops 1948. Potato varieties.—45 pp., 1 diag., Government Committee for the Compilation of the List of Varieties of Field Crops at Wageningen—Netherlands, 1948.

These descriptive notes on 36 potato varieties of interest to Dutch growers and breeders comprise references to their reactions to blight (*Phytophthora*) [*infestans*], wart disease [*Synchytrium endobioticum*], virus diseases (including stem-mottle [*R.A.M.*, 28, p. 87]), spraing, internal rust spot, hollow heart, and blueing.

Emilsson (B.) & Castberg (C.). **Undersökningar beträffande bekämpning av bladmögel och brunröta hos Potatis. II. Sedimentationshastigheten hos kopparhaltiga besprutningsmedel och dess betydelse för besprutningens resultat.** [Studies relating to the control of Potato blight. II. Sedimentation rate in copper containing sprays and its significance for the spraying result.]—*K. LandtbrAkad. Handl., Stockh.*, 87, 1, pp. 85–95, 3 graphs, 1948. [English summary.]

Continuing their studies on potato blight (*Phytophthora infestans*) control by means of copper-containing sprays at the Plant Research and Cold Storage Institute, Nynäshamn, Sweden [*R.A.M.*, 27, p. 293, and next abstract], the authors determined the sedimentation rates of 13 of these preparations.

This was effected by filling jars with the compound up to a certain height and dividing the columns into three parts at intervals up to 24 hours. A glass tube, connected with an Erlenmeyer flask and then with a large bottle filled with water, and fitted with a tap, was inserted to the requisite depth. The water slowly flowing from the bottle conveyed the uppermost third of the column to the Erlenmeyer flask and the middle third similarly introduced into another flask.

The values were found to differ widely, 2 per cent. Bordeaux mixture, 0·4 per cent. perenox, and 1 per cent. Ob 2300 having the slowest rates and 2 per cent. Bordeaux powder acme, 4 per cent. Bordeaux powder special jofur, and usit settling most rapidly. After 24 hours the proportions of copper in the lowest, middle, and uppermost thirds of the columns of the three first-named preparations were 90, 9, and 1; 75, 18, and 7; and 81, 14, and 5, respectively, compared with 99, 1, and 0; 100, 0, and 0; and 100, 0, and 0, respectively, for the three last-named. The values for 0·5 per cent. carsane, 0·5 per cent. obesan, 1 per cent. cuzol, 0·5 per cent. kopsit, and 0·5 per cent. cupro-Maag were intermediate. Comparing the sedimentation rates of Bordeaux mixtures containing different proportions of lime, 2 : 0·75 : 100 and 2 : 1 : 100 settled more slowly than 2 : 2 : 100, 2 : 4 : 100, and 2 : 0·5 : 100. The relation between stability and the chemical composition of Bordeaux mixture is briefly discussed.

Spraying tests with the Favorit knapsack sprayer commonly used in Sweden, showed that the variations in the copper content of the fungicidal solution were correlated with the sedimentation rate of the compounds. Thus, in those settling slowly, the copper content was almost constant, whereas rapid sedimentation connoted wide variations disqualifying the products for practical application. With the exception of Bordeaux special jofur, all the preparations could be used in a horse-drawn spraying machine with a mechanical agitator.

Emilsson (B.) & Gustafsson (N.). **Undersökningar beträffande bekämpning av bladmögel och brunröta hos Potatis. III. Preliminära försök med blastdödande medel.** [Studies relating to the control of Potato blight. III. Preliminary experiments with haulm-killing preparations.]—*K. LandtbrAkad. Handl., Stockh.*, 87, 2–3, pp. 199–215, 4 figs., 1948. [English summary.]

Following an introductory explanation of the advantages accruing from the destruction of potato haulms before lifting the crop to prevent blight [*Phytophthora infestans*] infection and a brief review of the pertinent literature [cf. *R.A.M.*, 28, p. 140 *et passim*], the writers describe their experiments at the Plant Research and Cold Storage Institute, Nynäshamn, and elsewhere in Sweden [see preceding abstract], on the efficiency and mechanism of some chemicals used for this purpose.

Sulphuric acid (12 per cent.), TAC2 [tar acid compound] (10 per cent.), and dowspray 66 improved (2 per cent.) were highly effective; only the last-named can be recommended at present for practical trials, sulphuric acid being restricted by its corrosive properties, while TAC is in short supply. Sodium chlorate (2 per cent.) and a mixture of copper sulphate (3 per cent.) and sodium chloride (1 and 3 per cent.) proved much less satisfactory. To cite some figures, in a test carried out on Bintje on 29th August, 1947, with sulphuric acid, dowspray, and dowspray plus aluminium sulphate (2 per cent.), the percentages of dead leaves and stems 21 days later were 100 and 100, 98 and 95, and 97 and 94, respectively. In a test to determine the relative suitability of two dates (29th August and 12th September) for spraying with TAC and copper sulphate plus sodium chloride (3:3), no difference could be detected between the results of the earlier and later treatments in respect of the former preparation, whereas the latter was significantly more effective, notably as regards the foliage, in the September application. None of the 20 varieties sprayed with sulphuric acid and TAC showed an appreciable degree of resistance to the chemicals, though there was a general tendency for the early varieties to sustain the heaviest losses. Towards the end of the season the haulms tend to become more sensitive to chemical action, so that the less efficient compounds may then be successfully applied.

It is evident that the premature interruption of development by haulm-killing must entail a reduction in the total yield of the crop. In certain varieties, however, such as Early Puritan, the mature tubers of which are very large and uneven, this loss may be more than counterbalanced by the increased percentage of saleable produce. The killing of green and vigorous haulms, provided the work is thoroughly accomplished, accelerates the setting of the tuber skins, a matter of practical importance especially in northerly districts, where potatoes are often lifted in a very immature state and the skins peel off, so that the crop presents a very unattractive appearance and the risk of infection is probably heightened.

Broadbent (L.). **Methods of recording aphid populations for use in research on Potato virus diseases.**—*Ann. appl. Biol.*, 35, 4, pp. 551–566, 8 graphs, 1948.

Methods of counting aphids infesting potato crops are reviewed and discussed. The results of surveys for aphids on experimental plots of Majestic potatoes carried out in 1946 in various parts of England showed that, although the numbers of *Myzus persicae* were below 100 per 100 leaves at many centres, spread of leaf roll and rugose mosaic virus [potato virus Y] was considerable, especially at Rothamsted. Numbers of aphids in mid-July bore little relation to the amount of virus spread. In comparing aphid infestations in various areas a more useful estimate for virus studies is obtained from counts of aphids per plant, rather than per 100 leaves, as site and planting date greatly affect the development and proportions of the crop at the different centres.

The results of aphid counts made at Rothamsted in 1947 are given and a counting method, based on the percentage of leaves infested, is described, which will

allow fairly accurate comparisons to be made between infestations on different potato varieties, on potatoes grown at different centres, or under different conditions. It is concluded that for most surveys a method which does not necessitate counting the aphids is adequate.

Locke (S. B.). **Studies on the chemotherapy of Potato virus diseases.**—Abs. in *Phytopathology*, 38, 11, p. 916, 1948.

Treatment of a hill of leaf roll infected Netted Gem potatoes [in Washington State: *R.A.M.*, 27, p. 493] with 0·2 per cent. 2,4-dichlorophenoxyacetic acid [see above, p. 228] induced complete masking of symptoms in the following new growth, and also in the first vegetative generation of plants arising from the tubers of the treated plant. Grafts made at intervals from these plants to healthy ones showed no transmission at first, but the proportions of transmission gradually increased up to 100 per cent. Symptom development was slower in the earlier transmissions and more rapid in the later ones relative to the rate of symptom appearance after transmission of untreated diseased plants. These data are interpreted as denoting a reduction in the amount of active virus in the treated plants and not merely masking of symptoms. Moreover, the reinoculation of first-generation vegetative progeny of the treated plant by grafting with scions from untreated leaf roll plants failed to induce the symptoms of the disease.

Milbrath (J. A.) & English (W. H.). **A late-breaking virus disease of Potatoes.**—Abs. in *Phytopathology*, 38, 11, p. 917, 1948.

An unusual graft-transmitted virus disease of potatoes has been observed in Oregon. After normal growth until late in the season, the plants become sickly, the stems stand erect, aerial tubers are formed in nearly every leaf axil, and the leaves turn yellow and roll. Severely infected plants remain small and chlorotic, with thickened nodes and aerial tubers. Outstanding differential features of the new virus disease include tuber perpetuation for at least three generations; late-season development of symptoms in apparently healthy plants from infected tubers; reduction in size (but not in number) of otherwise apparently normal tubers; and production by tubers or parts of tubers from an infected hill of normal, weak, or more or less severely diseased plants.

Ross (A. F.). **Local lesions with Potato virus Y.**—*Phytopathology*, 38, 11, pp. 930–932, 1 fig., 1948.

Of over 100 species of plants tested at Cornell University, New York, for their reaction to mechanical inoculation with the juice of *Nicotiana glutinosa* plants infected by potato virus Y, four were found to serve as local lesion hosts, viz., *Chenopodium urbicum*, *Physalis floridana* [cf. *R.A.M.*, 27, p. 493], *Lycium halimifolium* Mill., and *L. chinense* Mill. The first two are new hosts, but the two *L.* spp. may be identical with *L. barbarum*, reported by Dennis as a local lesion host for potato virus Y [*R.A.M.*, 17, p. 834].

Pale green to whitish-yellow, non-necrotic lesions develop on the infected leaves of *C. urbicum* 14 to 16 days after inoculation. On the two *L.* spp. distinct, brown, necrotic lesions appear in about ten days, after inoculation. On the last-named host the lesions enlarge and finally coalesce, and concurrently the leaves develop epinasty and begin to absciss acropetally. At the same time systemic symptoms become apparent, consisting of rugosity and necrotic spotting of the young foliage followed by leaf abscission.

Cowpea, U.S.D.A. seedling 41956, *C. urbicum*, *P. floridana*, and *L. halimifolium* were next compared as test plants for quantitative studies with virus Y. No lesions developed on cowpea, but all the others were found to serve the purpose in view, though *L. halimifolium* was later discarded on account of its undesirable growth

habits. Virus solutions differing in concentration by 20 per cent. generally resulted in significantly divergent numbers of lesions on *P. floridana*, *C. urbicum*, and the potato seedling when 48 or more leaves or half-leaves were inoculated with each of the dilutions. In these tests juice of diseased *N. glutinosa* plants was diluted 1 in 100 or 1 in 200 for *P. floridana* and 1 in 25 or 1 in 50 for the other two species. Under most conditions *P. floridana* proved to be the best of the plants tested for local lesions, of which four to ten times as many develop from a given inoculum as on any of the other species. Juice diluted 1 in 100 will produce from 20 to 200 lesions per half-leaf, while scattered infections are not infrequent at 1 in 10,000.

Necrotic lesions do not develop properly on *P. floridana* plants held near or above 80° F. Some strains of potato virus X produce lesions on this species, *C. urbicum*, and *L.* spp. similar to those caused by virus Y. Preliminary tests with the X-immune potato seedling 41956 indicate that it may be useful, not only for quantitative work with naturally infected potatoes (in which virus X may be present) but also for indexing work. Juice of triturated shoots or sprouts from Y-infected potatoes, diluted 1 in 5 or 1 in 10, regularly caused multiple lesion formation when rubbed on the seedling leaves. Further experiments showed that *P. floridana* can be used where virus X is present. Plants inoculated when young with a mild strain of virus X react to subsequent inoculation with Y by the development of as many lesions as are formed on healthy plants, or more. Mild strains of virus X induce no marked symptoms and protect the plant against all tested strains of virus X.

Baldacci (E.). **Ricerche ed esperienze sulle malattie del Riso (Oryza sativa L.). V. Sulle specie di Helminthosporium e di Sclerotium presenti in Italia. Revisione del materiale d'erbario existente presso il Laboratorio Crittogamico Italiano.** [Researches and experiments on the diseases of Rice (*Oryza sativa* L.). V. On the species of *Helminthosporium* and *Sclerotium* present in Italy. A revision of the herbarium material at the Italian Cryptogamic Laboratory.]—Reprinted from *Ann. Accad. Agric. Torino*, 90 (*1947–8*), 30 pp., 1 fig., [1948].

Continuing his studies on rice diseases in Italy [*R.A.M.*, 16, p. 405; 17, p. 623; 25, pp. 357, 472], the author gives a full account of his work on two strains of *Helminthosporium* (Nos. 44 and 46) and one of *Sclerotium* (No. 1). *Helminthosporium* No. 44 and *Sclerotium* No. 1 were obtained from the same plants, near Pavia, in 1944, while *Helminthosporium* No. 46 was isolated in 1946 in other localities. The plants from which the first two were isolated were short and growing very slowly. The ears had formed by 10th August, but the inflorescences were short and had few spikelets. Slight chlorosis was present and some plants were greenish-yellow with withered tips. There was a double or triple branching-out of roots from the bottom node of the stem. In the earliest stages of growth the leaves were severely infected by the *Helminthosporium*, the attack being very severe in August, during flowering and when the spikelets were ripening. The fungus spread from the leaves to the rachis and glumes. At harvest the *Sclerotium* (which had previously escaped notice) was found in the medullary cavity and the tissues of the leaf sheaths. *Helminthosporium* strain 46 occurred in a year when rice was also severely attacked by *Piricularia oryzae*.

The sclerotia of *Sclerotium* No. 1 were black, minute bodies measuring about 260 μ; later, the black spots on the outer sheaths produced falcate, 3-septate conidia resembling those of *H. sigmoideum* Cav. (*Leptosphaeria salvinii*) [ibid., 26, p. 415]. In culture on carrot agar and rice agar the sclerotia measured about 370 to 400 μ.

Comparison of these three fungi with the original exsiccata and descriptions of other *H.* species found on rice showed that the *Helminthosporium* strains were identical with *H. oryzae* (*Ophiobolus miyabeanus*) [ibid., 26, pp. 143, 533], while the

Sclerotium was identical with *S. oryzae* [loc. cit.]. The ascigerous state, *O. miyabeanus*, has not so far been reported from Italy, where, however, rice is known to be attacked by *H. sigmoideum* [cf. ibid., 11, p. 469].

Baldacci (E.). **Ricerche ed esperienze sulle malattie del Riso (Oryza sativa L.). VI. L'Elmintosporiosi del Riso da Helminthosporium oryzae.** [Researches and experiments on the diseases of Rice (*Oryza sativa* L.). VI. Helminthosporiosis of Rice caused by *Helminthosporium oryzae*]—Reprinted from *Ann. Accad. Agric. Torino*, 90 (*1947–8*), 26 pp., [1948].

Continuing his studies on rice diseases [see preceding abstract], the author observed that leaf blades of rice plants attacked by *Helminthosporium oryzae* [*Ophiobolus miyabeanus*] in Italy in the middle of July bear on both leaf surfaces circular or elongated spots 2 to 5 mm. in diameter, sometimes becoming confluent and causing complete disorganization of larger areas. The spots have a chestnut or dark chestnut halo and a grey or yellowish-grey centre, with sometimes a dark red ring between the two. On the leaf sheaths, both inside and outside, at the same time of year the diffuse spots are dark chestnut and mostly round the ligules. On the leaf blades the spots are more or less abundant according to the intensity of the attack, and they can be found even on plants only 30 days old. When severely infected, the leaf blades wither prematurely. By the middle of August field plants have completely withered leaves covered with reddish or yellow-red spots, circular or subcircular when isolated, irregular when confluent. The author has not observed infection on the nodes, or at the base of the culm where it is under water; attacks by other species of *Helminthosporium* are found on the latter site.

The last internode, bearing the panicle, the rachis, and the rachillae are readily attacked. They have large irregular, indefinite spots or diffuse discolorations, sometimes ring-shaped, the lesions being 1 to 2 cm. long. Where the lesions are annular, the whole panicle dries up without the caryopses ripening, assuming a greyish colour. The spots are chestnut, shading off into grey or black. On the spikelets black or blackish mouldy patches develop which are almost velvety and may cover the whole glume. These spikelets and those of the panicles infected at the base have reduced or aborted caryopses. The glumes are slightly divaricated, and red to yellowish. Attacks on the spikelets appear to be very diffuse, and escape detection. They are, however, present even when leaf spotting is faint or sparse. Somewhat conspicuous areas of discoloration form stripes on the caryopses, or more often extends over the whole surface.

Experimental inoculations of rice plants with an aqueous suspension of the fungus gave positive results on plants from the seedling to the adult stage. The leaves, culms, rachides, and spikelets were susceptible, but not the nodes; while the panicle appeared to develop resistance only in the milky stage. Field observations showed that rainy weather during earing and flowering is a predisposing factor under Italian conditions. Bordeaux mixture, Caffaro powder, and uspulun caused, respectively, 70·9, 72·2, and 71 per cent. non-germination of *H. oryzae* conidia as compared with 93·5, 92·3, and 87 per cent. for similar treatment against strain G30 of an *Alternaria* of the *tenuis* [*R.A.M.*, 25, pp. 222, 223] group. It is concluded that these materials are not likely to prove effective for seed disinfection.

Aiyar (S. P.). **The effects of potassium deficiency on Rice.**—*Proc. Indian Acad. Sci.*, Sect. B, 28, 6, pp. 202–226, 2 pl., 8 graphs, 1948.

In a study carried out in 1940 to determine the cause of a disease of rice known as 'amyitpo' near Mandalay, Burma, plants grown in pots in soil from diseased areas were stunted, bushy, and of a blue-green colour, with short, sappy stems, and short, stiff, erect leaves ending in a hook-shaped curvature or spread out almost at right angles to the stem, terminating in a wide upward curvature. The foliage

bore chocolate-coloured patches and there was a progressive shortening of the internodes from the oldest to the youngest. The older leaves and leaf sheaths showed extensive desiccation (entirely unaccompanied by yellowing). Tillering continued throughout the life of the plant, with a high percentage of decay. Grain formation was substantially reduced and the grains were widely spaced on the panicle.

Experiments in potassium-deficient culture solutions confirmed most of the morphological and colour symptoms [cf. *R.A.M.*, 16, p. 339 *et passim*]. Applications of potassium sulphate at the rate of 80 lb. per acre prevented the development of any of the foregoing symptoms, the plants in the treated soil being tall and completely normal in all respects. The amendment also resulted in large increases in the straw and grain yields. Production was likewise stimulated by soil treatments with ammonium sulphate, which failed, however, to alleviate the deficiency symptoms. Phosphoric acid depressed the action of potash when the two nutrients were used together. Analyses of the composition of the plants revealed an abnormally low percentage of potash in the absence of the fertilizer, accompanied by unduly high proportions of nitrogen, phosphoric acid, calcium, magnesium, and iron. As a result of the potassium sulphate soil amendments this position was reversed.

The etiology of the potassium deficiency in the local soils is discussed. The principal factors appear to be the ionic antagonism of calcium and magnesium, on the one hand, and assimilation of an abnormally high proportion of potassium by the large increase in soil microflora on the other. The condition is unexpected inasmuch as the soil appears to be rich in potassium as estimated by chemical methods.

Van Hell (W. F.). **Resultaten van de bestrijding van de witte wortelschimmel in een herplanting.** [Results of the control of the white root fungus in a replanting.]—*Arch. Rubbercult.*, 26, 3, pp. 221–251, 2 graphs, 1948. [English summary.]

This is a detailed, fully tabulated account of the results of experiments in white root rot (*Fomes lignosus*) control in young *Hevea* rubber replantings on an estate on the east coast of Sumatra. The essential information contained in the report has already been noticed from another source [*R.A.M.*, 28, p. 163].

Chesters (C. G. C.). **A contribution to the study of fungi in the soil.**—*Trans. Brit. mycol. Soc.*, 30, pp. 100–117, 5 figs., 1948.

Studies on the fungal content of soils in the Midlands and elsewhere by means of an improved, standardized version of the author's immersion-tube method [*R.A.M.*, 20, p. 177] are described. The routine adopted consists in (1) the removal of a core of soil by means of an alcohol-sterilized borer, (2) inserting in the hole so formed an immersion tube containing sterile nutrient agar, which is removed seven days later for the isolation of the fungi it contains, (3) preparing a water suspension from the core of soil and separating, by washing, the organic debris in it on screens of different pore size, and (4) isolating the fungi in the suspension and debris.

The immersion-tube method with agar media demonstrated that in cultivated and pasture soils the dominant fungi are species of *Mortierella*, *Mucor*, and *Pythium*. Species of *Rhizoctonia*, *Rhizopus*, *Zygorrhyncus*, and *Fusarium* are next in order of frequency. In any one isolation the nature of the fungi isolated depends on the medium used. The evidence showed that when active, widespread mycelium of *Trichoderma viride* is present in soil, it can be recovered in almost every instance by the immersion-tube method in the absence of competition from other fungi, although it fails to appear in routine isolations. It appears, therefore, that the method readily isolates active mycelium which happens to come into contact with the capillaries.

Immersion-tube isolations in soil extract agar during November and December, 1945, from pasture turf overlying a Keuper soil yielded, in descending order of frequency, sterile mycelia, *Mortierella* sp., *Mucor* sp., *T. viride*, *P. intermedium*, *Botrytis cinerea*, and *Circinella* sp. At the same time, isolations were made from root fragments separated from the mineral matter of the turf by dispersing the organic debris in water, washing it free of mineral fragments on sterile screens, and thoroughly washing in sterile water. The species most frequently isolated were *Mucor hiemalis*, *Penicillium* sp., *T. viride*, *Mortierella humilis*, and *Absidia cylindrospora*; also isolated was *Helminthosporium biforme* n.sp., which was obtained from two root fragments, but also recurred with regularity on root debris.

These experiments having demonstrated the possibility of obtaining washed debris by aseptic transfer from a soil sample, a more efficient means of handling the sample was devised, consisting of three units, sterilized separately and assembled with quick-fit metal unions. The first was a 2-l. reservoir for sterile distilled water, with an air filter attached to the inlet. The second consisted of a screening tube with a coarse-mesh screen fixed by a copper ring in the middle of its length and a fine-mesh screen in the lower bung of the tube. The upper bung carried an air filter and also a length of rubber tubing joined to the exit tube of the first reservoir. Under the fine-mesh screen an inverted Y-tube allowed the washing water to pass either into a sample tube held under a dust bell or, by means of pressure tubing, into the third unit, consisting of a 2-l. reservoir, provided with an air filter at the exit. The soil sample in a sealed tube is transferred to a sterile bottle containing 50 ml. water and ten glass beads and mechanically shaken for 30 minutes. The contents are decanted and by means of the apparatus described the debris is washed free from all mineral matter. It is then transferred to 100 ml. sterile soil extract agar and plated. After incubation the fungi growing from the particles of debris are isolated. The results showed that a slightly wider range of species was obtained from the suspension than from the washed debris, only four species being common to both methods of isolation.

This method of investigating the fungal flora of the soil should provide fuller information of the biological relationships of soil fungi than has hitherto been possible.

In an appendix to this paper a description is given of *H. biforme* Mason & Hughes, which conforms closely to *Brachycladium ramosum* Bainier, but as this binomial is illegitimate and the fungus is not a typical *Brachycladium* the new name is proposed. It is included in *Helminthosporium* as the conidia, formed on both micro- and macronematous conidiophores, are produced in an ear, each formed successively on the growing point of the conidiophore.

Salmon (E. S.). **Thirty-first report on the trial of new varieties of Hops, 1947.**—*J. Inst. Brew.*, N.S., 46, 1, pp. 29–38, 1949.

It has been decided by the Hops Marketing Board that the propagation of the new varieties, OR 55 and OJ 47, resistant to *Verticillium* [*albo-atrum*: *R.A.M.*, 28, p. 195] shall be undertaken on a large scale in a Kentish nursery, so that rooted sets may be made available to growers wishing to plant up gardens where soil infestation by this pathogen precludes the cultivation of Fuggle and other commercial varieties. The estimated yields of the early OJ 47 at East Malling from 1940 to 1947 (omitting 1945, when no records were taken owing to mould [*Sphaerotheca humuli*] damage) ranged from $10\frac{1}{2}$ to $27\frac{1}{4}$ cwt. per acre, the latter figure, attained in 1947, being considered phenomenal for an early variety. The corresponding figures for the late OR 55 were from $17\frac{1}{2}$ to $25\frac{3}{4}$ ($22\frac{1}{4}$ in 1947).

The FF 21 variety, which suffers no ill effects from the hop mosaic virus [loc. cit.], has been named 'Early Choice'. During its 19 years under observation at Wye, FF 21 has proved very resistant to downy mildew [*Pseudoperonospora humuli*]

and been little affected by mould. A mid-season variety meriting wider cultivation is Brewer's Stand-by, the preservative value (resin content) of which is nearly as high as that of Brewer's Gold, while its cones are resistant to *P. humuli*. The late Sunshine Hop and Concord Hop are also decidedly resistant to downy mildew, and the former, with a relatively high preservative value, is much sought after by United States growers.

CHOWDHURY (S.). **Diseases of Pan (Piper betle) in Sylhet, Assam. Part 7. Effects of some soil treatments on the incidence of sclerotial wilt. Part 8. Effect of temperature on the development of sclerotial wilt of Pan.**—*Proc. Indian Acad. Sci.*, Sect. B, 28, 6, pp. 227–246, 1 graph, 1948.

A report is presented on the results of experiments covering the period from 1940 to 1946 on the effects of certain soil treatments on the wilt of *Piper betle* caused by *Sclerotium rolfsii* in the Sylhet district of Assam [*R.A.M.*, 27, p. 95].

The percentage of mortality was considerably reduced by deep ploughing and crop rotation. For instance, before planting *P. betle*, continuous cropping for four years with *Imperata arundinacea*, rice, tobacco, and *Colocasia antiquorum* effectively combated the disease. Other helpful practices included applications to the soil of organic manures, cow dung, and composts and the turning-under of green manures. Ammonium sulphate, alone or combined with superphosphate or potassium chloride, or both, was the best of the fertilizers tested for the suppression of the disease. Superphosphate and potassium chloride, used separately or in conjunction, were less effective but kept the level of mortality below that occurring in the control plots.

The influence of atmospheric temperature on the growth of *S. rolfsii* and of soil temperature on the development of wilt were also studied. The optimum temperature for the vegetative growth of the fungus in culture was 28° C. and the maximum number of sclerotia was formed at 28° and 30° in culture. The optimum temperature for sclerotial germination in Dox agar was also 28°. The same temperature in the soil provided ideal conditions for wilt development, though the disease was quite severe, too, at 25° and 30°.

KHANNA (K. L.) & CHACRAVARTI (A. S.). **Some observations on juices of diseased Sugarcane.**—*Curr. Sci.*, 18, 1, p. 19, 1949.

This is a preliminary tabulated report on the results of juice analyses of healthy sugar-canes and those affected by red rot [*Physalospora tucumanensis*: *R.A.M.*, 28, p. 161] and wilt (*Cephalosporium sacchari*) in Bihar [ibid., 22, pp. 153, 197]. Both diseases, especially red rot, caused reductions in the sucrose content and increases in invert sugars, total colloids, and ash. Thus, the determinations for Brix, polarization, purity, invert sugars, total colloids, and ash in sound and red rot diseased Co. 331 canes were 19·9 and 9·5, 17·58 and 4·62, 88·5 and 48·6, 2·46 and 25·47 (per cent. of total solids), 2·41 and 11·16 per cent., and 2·01 and 6·53 per cent., respectively, while the corresponding figures for healthy and wilted Co. 385 were 18·4 and 12·8, 15·29 and 7·3, 83·1 and 57·03, 2·5 and 12·19 per cent., 6·4 and 8·61 per cent., and 3·72 and 7·3 per cent., respectively.

MUNGOMERY (R. W.). **Report of the Division of Entomology and Pathology.**—*Rep. Bur. Sug. Exp. Stas Qd, 1947–48*, pp. 31–40, 1948.

It is stated in this report [cf. *R.A.M.*, 27, p. 384] that during the period under review sugar-cane leaf scald (*Xanthomonas albilineans*) [ibid., 28, p. 197] was less prevalent in Queensland than in the previous year owing to the use of plants from disease-free areas. Many farms in the leaf scald belt were free from infection. It is hoped that the disease will be brought under control even if the susceptible Q. 44 and Trojan are grown. In resistance trials Q. 54 and Orion showed susceptibility.

There was no further spread of gumming disease (*Xanthomonas vasculorum*) [loc. cit.] in the Mossman mill district and the 1947 quarantine area still includes all known diseased farms.

As the season was one of light rainfall, chlorotic streak was again confined to the wet, low-lying localities, occurring in the north, and at Maryborough and Moreton in the south. No fresh outbreaks were reported. In certain northern mill areas the practice of bringing plants from the highlands for the control of leaf scald should also help in the control of chlorotic streak. This method alone, however, will not be sufficient to eradicate the disease, because of the rapid infection rate in the lowlands. In the Babinda area Orion showed 36 per cent. diseased stools within nine months and Pindar 12; Badila showed no infection. In the ratoon crop, Akbar, Vesta, Q. 28, and Q. 49 were infected, although the susceptible P.O.J. 2878 remained healthy. All varieties of greater susceptibility than this cane need careful watching. In a yield trial with P.O.J. 2878 on Maroochy River alluvial soil in the Moreton mill area, hot-water treated plants were free from chlorotic streak except for an occasional diseased stool. Diseased, hot-water treated plants, yielded 33·5 tons per acre; diseased, untreated 24·1; healthy, treated 36·4; and healthy, untreated 34·5. The difference of 10 tons between diseased and healthy (untreated) crops represents a loss of nearly 30 per cent. due to the direct effects of the disease. Other trials showed that the time of planting has a definite effect on the spread of the disease, but it is not clear whether it is due to this factor in itself, to the longer exposure to infection, or to the growth stage at some particular time.

The Fiji disease [loc. cit.] position was very satisfactory outside the Bundaberg and Moreton district. In the former area 2,466 diseased stools from 12,044 acres inspected have been destroyed; in the latter 8,091 affected stools were rogued in the 3,680 acres inspected, bringing the total destroyed during the last five years to nearly 50,000 stools.

In the Mackay district the Cane Pest and Disease Control Board destroyed only 1,062 stools affected with sugar-cane dwarf [virus] disease, this decrease being mainly due to the dry conditions and to the reduced use of susceptible varieties.

Mosaic disease occurred again in small amounts in the Burdekin district and was found scattered throughout the Mackay district, causing, however, little damage. In mosaic resistance trials at Bundaberg and Nambour the spread of the disease was satisfactory in inoculated lots, but natural spread was only fair at Nambour and poor at Bundaberg. In view of the unreliable natural spread it is suggested that in all trials plants should be inoculated.

A vigorous programme of roguing or complete ploughing of severely diseased fields, planting of healthy material, and the use of resistant varieties has eliminated downy mildew (*Sclerospora sacchari*), ten years ago the most serious sugar-cane disease in Queensland, from all districts except Bundaberg. In this area 725 diseased stools, all in the red volcanic soil of the 'Woongarra', were destroyed in the 12,044 acres inspected. Since 1941 the number of infected stools has remained fairly static in this area, fluctuating between 1,000 and 5,000, depending mainly on seasonal conditions. During the last years, however, the planting of the very resistant C.P. 29/116, and to a lesser extent Q. 49, has greatly helped in the reduction of the disease.

In South Queensland red rot (*Physalospora tucumanensis*) affected Co. 290 most severely, but Vesta, Q. 49, and Q. 28 also showed some infection later in the season. The disease was also prevalent at Mackay where Co. 290, Q. 28, and to a lesser extent Q. 50 became infected.

In 1947 the ratoon crops of Q. 28 in the Mackay district suffered heavy losses from a disorder of undetermined origin, possibly due to the use of physiologically weak plants. The very dry conditions aggravated the trouble which reduced yields and caused the death of many crops before they could be harvested. The

1948 crop is again affected by the disorder, but owing to better growing conditions the cane is showing less damage.

Miscellaneous records include top rot (*Xanthomonas rubrilineans*), which was not serious in the northern areas, but the red stripe stage was prevalent in the south, especially in Q. 49. For treating setts against pineapple disease (*Ceratostomella paradoxa*) a tank mounted on rollers and fitted with a crane which dips the detachable planter boxes into the mercurial solution is being used; with three such boxes there is very little delay in the planting operations. A five-minute dip is sufficient. Germination trials showed that under adverse conditions the treatment with mercurial solutions gave excellent results even when pineapple disease was not obviously present. Rind disease (*Pleocyta sacchari*) [ibid., 26, p. 335] occurred in some standover crops of Q. 47 and Q. 49 in the south.

STEINDE (D. R. L.). **Droopy-top disease of Sugar Cane.**—*Cane Grs.' quart. Bull.*, 12, 4, pp. 175–177, 1948. [Abs. in *Sugar*, 43, 12, pp. 52, 54, 1948.]

The name 'droopy top' is applied to a disorder affecting sugar-cane on the poorer sandy types of soil in Queensland. At first it was observed chiefly on the Co. 290 variety, but during the last two years the Q. 28, Q. 42, and C.P. 29/116 have also shown signs of the trouble, to which P.O.J. 2878, on the other hand, appears to be resistant. The symptoms on Co. 290 consist of longitudinal chlorotic stripes on the leaves between the major vascular bundles, with the tissues adjacent to the latter remaining green, thus producing an effect of alternating green and creamy-white parallel stripes. In older leaves the margins and tips wither, and many are attacked by eye spot [*Helminthosporium sacchari*], ring spot [*Leptosphaeria sacchari*], and leaf freckle. Such leaves die prematurely and remain hanging on the stem in the form of a column. The youngest leaves are very slow to unfurl, forming a long, tightly wrapped spindle which droops over, together with the rest of the top. Some of the young sticks almost lie on the ground but the more mature ones are upright though they often bend outwards, and the general aspect of the whole stool is drooping. Severely diseased stools are very stunted and often killed. The dwarfing occurs over areas up to or exceeding 66 ft. in diameter, but usually less. In the centre of these patches the stools may be reduced to mere grassy tufts, while towards the edge they increase to normal size, thereby producing saucer-shaped depressions in the field.

Cuttings from affected sticks gave rise to normal plants, which have remained healthy for two years, so the condition is evidently not transmitted through the 'seed' piece. It is probably caused by some mineral deficiency in the soil, and the results of recent trials with several minor elements indicate that combined copper and zinc amendments will stimulate growth on the weak patches [cf. *R.A.M.*, 28, p. 196].

NOLLA (J. A. B.). **Sugar Cane diseases in Puerto Rico.**—*Sugar*, 44, 2, pp. 34–37, 1 fig., 1 graph, 1949.

A survey of sugar-cane diseases in the western part of Puerto Rico [*R.A.M.*, 5, p. 187; 15, p. 606], initiated in 1943, revealed the presence of the sugar-cane mosaic virus, red rot (*Colletotrichum falcatum*) [*Physalospora tucumanensis*], chlorotic streak, brown stripe (*Helminthosporium stenospilum*), eye spot (*H. ocellum*) [*H. sacchari*], red stripe (*Phytomonas* [*Xanthomonas*] *rubrilineans*), pokkah boeng (*Fusarium moniliforme*) [*Gibberella fujikuroi*], ring spot (*Leptosphaeria sacchari*), and gummosis (*P.* [*X.*] *vasculorum*).

At the present time mosaic and gummosis no longer constitute a threat to the industry, since the cultivation of susceptible varieties has been largely discontinued and extreme vigilance is observed on the few plantations where any remain. On the contrary, some of the other diseases listed are assuming ever greater importance.

Red rot and chlorotic streak are spreading rapidly, and should be combated by the establishment of seed plots or propagation fields, where strict selection can be practised. The chlorotic streak virus succumbs to 20 minutes' immersion of the canes in water heated to 52° to 53° C. [ibid., 20, p. 178; 28, p. 197]. Treatment is necessary in the case of the highly susceptible but economically most valuable varieties, P.O.J. 2878, P.O.J. 2940, P.O.J. 2961, M. 317, M. 344, B.H. 10/12, P.O.J. 36, Co. 418, P.R. 907, and P.R. 908. During the last three years resistance has been demonstrated in P.O.J. 2725, Co. 281, Co. 290, Co. 421, and Kavangire, and moderate resistance in F.C. 916, M. 28, M. 261, M. 338, and S.C. 12/4. Resistance to red rot, regarded as the most dangerous disease on the Island at the moment, was shown by M. 28, B. 35–245, M. 261, and P.R. 905, while P.O.J. 2878, Co. 421, M. 338, B. 34–104, B. 37–161, and P.R. 907 proved very susceptible.

Eye spot causes heavy damage in the dry season, and therefore susceptible canes should be planted from June to September and cut in the following May or June, thereby enabling the ratoons to escape the worst effects of the disease. The most susceptible varieties are B. 34–104, Co. 419, B.H. 10/12, and S.C. 12/4; Kavangire, M. 28, M. 275, M. 261, P.O.J. 2725, P.O.J. 2940, and P.O.J. 2878 are very resistant.

Brown stripe, unlike eye spot, is more prevalent in the rainy season, and susceptible varieties, such as Co. 419, should therefore be cut and propagated between January and April. P.O.J. 2878, P.O.J. 2940, P.O.J. 2725, M. 28, M.338, and S.C. 12/4 are highly resistant to *H. stenospilum*.

Red stripe, pokkah boeng, and ring spot are of minor importance, and dry rot (*Ligniera vasculorum*) [ibid., 21, p. 351] has rapidly disappeared from Puerto Rico.

Barrett (J. T.). **Some conditions contributing to the development and germination of oospores in the genus Phytophthora.**—Abs. in *Phytopathology*, 38, 11, p. 913, 1948.

The results of experiments involving the pairing of male and female strains of *Phytophthora drechsleri* with several isolates of *P. palmivora* demonstrated sexual compatibility between these two species and confirmed observations of previous workers as to the occurrence of two sex strains in the latter [cf. *R.A.M.*, 27, p. 297]. Oospores derived from crossing the two sex strains of *P. drechsleri* were germinated and 22 cultures from as many oospores established. No oospores were found in any of these single cultures, but when back-crossed with the two parents, 14 reacted with the male only and six with the female only. In each case oospores were produced in abundance. Oospores resulting from crossing two isolates of *P. infestans* (one from potato and one from tomato) with the female *P. infestans* [? *P. drechsleri*] were germinated, and one culture was back-crossed with the *P. drechsleri* parent resulting in the production of a profusion of oospores; a dual culture with the male was sterile.

Wilhelm (S.). **The effect of temperature on the taxonomic characters of Verticillium albo-atrum Rke. et Bert.**—Abs. in *Phytopathology*, 38, 11, p. 919, 1948.

A temperature difference of 3° to 6° within the growth range (10° to 31° C.) of *Verticillium albo-atrum* may induce in this fungus marked divergences in cultural appearance and morphological characters, especially of the resting stages [cf. *R.A.M.*, 19, p. 368]. Colonies grown at low temperatures (10° to 22°) or during the winter at Berkeley, California, are jet-black and consist almost entirely of thick microsclerotial crusts. At higher temperatures (25° to 31°) or during the summer in the same locality, the colonies are creamy-white and microsclerotial development is sparse. Thus, the resting structures of *V. albo-atrum*, particularly the microsclerotia, and colony appearance are not reliable characters for specific separation. Colonies grown at low temperature correspond to the concept of *V. dahliae* as interpreted by Van der Meer [ibid., 4, p. 495] and Keyworth [ibid., 22, p. 132]

and to the *niger* group of *V. dahliae* as described by Berkeley [cf. ibid., 11, p. 130]. These observations on temperature response apply only to the wild type or conidial constituent of *V. albo-atrum*, not to the stable white mycelial variants.

WALLACE (G. B.) & WALLACE (MAUD M.). **Tanganyika Territory fungus list : recent records. X.**—*Mycol. Circ. Dep. Agric. Tanganyika* 23, 5 pp., 1948. [Mimeographed.]

It is stated in this circular [cf. *R.A.M.*, 27, p. 158 and next abstract] that a *Fusarium* species, identified by W. L. Gordon as *F. lateritium* var. *uncinatum* was isolated from the roots, collar, and stems of dying pigeon pea plants (*Cajanus indicus*) [ibid., 20, p. 496; 27, p. 155]. Inoculations of the fungus into two healthy seedlings induced wilting and death after 24 and 30 days, respectively. The fungus was re-isolated from one of them. The disease, which usually originates in the soil, attacks both injured and uninjured roots and the mycelium spreads upwards through the wood vessels, blocking them eventually. Infected plants rarely survive. In India [ibid., 28, p. 56] where the disease is serious, it is recommended to grow a crop of tobacco on pigeon pea land every three to four years. In Tanganyika Territory it is considered that it may be sufficient to remove and burn the affected plants.

Other new disease records include potato leaf roll, black leg of *Pelargonium* caused by a species of *Pythium* (apparently a strain of *P. debaryanum*), and wilt of *Cestrum elegans* due to *Macrophomina phaseoli* in its *Rhizoctonia* state. The occurrence of cypress canker (*Monochaetia unicornis*) [ibid., 27, p. 455] was suspected in Tanganyika Territory in December, 1947, and its presence in the Usambara Mountains has now been confirmed.

WALLACE (G. B.) & WALLACE (MAUD M.). **Tanganyika Territory fungus list : recent records. XI.**—*Mycol. Circ. Dep. Agric. Tanganyika* 24, 5 pp., 1948. [Mimeographed.]

Further fungus records for Tanganyika Territory [see preceding abstract] include blast (*Piricularia oryzae*) on *Eleusine coracana* [*R.A.M.*, 27, p. 581] in the Lake Province. The fungus has previously been found on rice, but not on this host. Flax at Lyamungu was attacked by *Macrophomina phaseoli*, and at Ngare, Nairobi, by mildew (*Oidium lini*). *Ascochyta caricae* [ibid., 27, p. 483] is responsible for brown and white leaf spots, fruit rot, and also of die-back of neglected papaw trees, the diagnosis being confirmed in the laboratory. To control the disease the tops of infected trees should be cut and burned, and to encourage the development of new shoots the cut should be made about a foot above a suitable side-shoot or bud, or about 2 ft. from ground level. All trash should be collected and buried, as it is a dangerous source of infection. Subsequently the trees should be sprayed with a lime-sulphur solution (1–35) or perenox (1¾ lb. in 40 gals.); Bordeaux mixture tends to injure the young leaves. The incidence of mosaic on papaw seems to be increasing. Passion fruits at Lushoto were attacked by *Alternaria passiflorae*. Sunflower plants in the Moshi district suffered from a bacterial wilt with blackening of the base of the stem, which spread upwards three or four feet until the plants eventually fell over. It is suspected that *Xanthomonas solanacearum* [ibid., 27, p. 353] is the causal organism, which, however, remains to be confirmed. Bird's-eye leaf spot (*Cercospora theae*) reported on old tea leaves in the Usambaras, and a leaf spot due to *Phyllosticta theae* recorded from Mufindi, are of very little importance. The causal organism of leaf spot of nasturtium [*Tropaeolum majus*: ibid., 27, p. 158], which occurred again in the Northern Province, has now been identified by Dr. Bond as *Heterosporium tropaeoli* [ibid., 27, p. 197]. Prof. K. F. Baker, to whom specimens were sent, confirmed that the disease is the same as that which

occurs in the United States [ibid., 26, p. 492] and Guatemala. A disfiguring leaf spot of zinnias was found to be caused by *Alternaria zinniae* [ibid., 25, p. 581].

Hansford (C. G.). **Chinese fungi collected by S. Y. Cheo.**—*Farlowia*, 3, 3, pp. 269–283, 18 figs., 1948.

Full descriptions are given of 19 fungi, including 14 new species and two new varieties, collected by S. Y. Cheo in different parts of China, among which may be mentioned *Irene quercina* n.sp. on oak and *I. rosae* on *Rosa roxburghii*.

Hansford (C. G.) & Thirumalachar (M. J.). **Fungi of South India.**—*Farlowia*, 3, 3, pp. 285–314, 37 figs., 1948.

Thirty species and one variety in this critically annotated list of 39 fungi are new to science, and there are also a number of new records for Mysore. *Armatella cinnamomi* n.sp. was collected on cinnamon (*Cinnamomum zeylanicum*), *Meliola mangiferae* [*R.A.M.*, 19, p. 617] and *Asterolibertia mangiferae* n.sp. on mango, and *Asterina congesta* on sandal.

Linder (D. H.). **Fungi.** *Ex* **Botany of the Canadian Eastern Arctic. Part II. Thallophyta and Bryophyta.**—*Bull. nat. Mus. Can.* 97, pp. 234–297, 7 pl., 1948.

Included in this critically annotated list of fungi collected by Dr. N. Polunin in the Canadian Eastern Arctic, mostly on his expedition of 1936, are *Claviceps purpurea* on *Arctagrostis latifolia* and *Dupontia fisheri*; *Venturia chlorospora* in association with *Mycosphaerella salicicola* on *Salix herbacea*; *V. ditricha* on the same host and *Cladosporium bruhnei* n.nom. (*Hormodendron hordei*) on *Elymus arenarius* var. *villosus*. The last-named fungus is so far known only from Germany and the Canadian Eastern Arctic; probably, however, it is far more plentiful and widespread than these two records indicate, its further occurrences having doubtless been lost sight of through confusion with *C. herbarum*, *C. graminum*, and perhaps yet other species.

Steyaert (R. L.). **Contribution à l'étude des Pestalotia du Congo belge.** [Contribution to the study of the *Pestalotia* species of the Belgian Congo.]—*Bull. Jard. bot. Brux.*, 19, 2, pp. 173–186, 3 pl., 1948.

Included in this critically annotated list of 13 species (three new and one new variety) of *Pestalotia* [cf. *R.A.M.*, 27, p. 451] from the Belgian Congo are *P. mangiferae* [ibid., 12, p. 77] and *P. annulata* on mango, *P. stictica* on *Coffea canephora*, *P. sonsensis* on *Ceratonia siliqua*, and *P. aeruginea* n.sp. on tea. The last-named species, which forms ashen-grey, sharply defined, irregular spots on the leaves, is remarkable for the polymorphism of its fusoid conidia, 30 to 39 (mostly 35) by 7 to 8 μ, tapering at the base to a pedicel 3 to 8 (mostly 5) μ in length. Besides the predominant normal forms with three setae, 17 to 30 (mostly 24) μ in length, there is a great diversity of anomalous types, ranging from muticous, completely coloured ones to those with only a single tinted cell, while the pedicel was absent in one case.

Cummins (G. B.). **New species of Puccinia on Lauraceae from China.**—*Bull. Torrey bot. Cl.*, 76, 1, pp. 31–38, 12 figs., 1949.

Descriptions are given of ten closely related new species of *Puccinia* found on Lauraceae in China. A key for the differentiation of the species is provided.

Rayss (T.). **Nouvelle contribution à la mycoflore de Palestine. (Quatrième partie.)** [A new contribution to the mycoflora of Palestine. (Fourth part.)]—*Palest. J. Bot.*, J. Ser., 4, 2, pp. 59–76, 1947. [Received February, 1949.]

This further instalment of the author's critically annotated studies on the mycoflora of Palestine [*R.A.M.*, 26, p. 130] is devoted to the Ascomycetes, of which 57 species are listed, 40 for the first time in the present series.

Marchionatto (J. B.). **Nota preliminar sobre los géneros de hongos Vermicularia', 'Colletotrichum', y 'Ellisiella'.** [Preliminary note on the genera *Vermicularia*, *Colletotrichum*, and *Ellisiella*.]—*Physis, B. Aires*, 20, 56, pp. 115–116, 1 fig., 1947. [Received February, 1949.]

Of late years there has been an increasing tendency to refer to the genus *Colletotrichum* species characterized by superficial or erumpent acervuli and hyaline, fusoid, curved conidia with pointed tips. According to Saccardo, however, this genus is reserved for species with subepidermal acervuli and oblong, straight, blunt-tipped conidia, and it cannot, therefore, accommodate those with the characteristics mentioned above. The latter, moreover, are also disqualified by their subepidermal acervuli for inclusion in *Vermicularia* [*R.A.M.*, 5, p. 124; 8, p. 268] and it is suggested that they be referred to *Ellisiella*.

In this connexion the author questions the propriety of Saccardo's reference to *Ellisiella* of *E. mutica*, which has conidiophores with two to three acrogenous conidia, with apices prolonged into a filiform appendage, and differs widely from the type species, *E. caudata*. It is evident that an amendment in the genus *Ellisiella* is called for, and the writer proposes to maintain within it *E. caudata* and to transfer *E. mutica* and all species of *Vermicularia* or *Colletotrichum* with subepidermal or erumpent acervuli, and fusoid, curved, and apiculate conidia to *Colletotrichopsis* Bub.

Holm (L.). **Taxonomical notes on Ascomycetes. I. The Swedish species of the genus Ophiobolus Reiss sensu Sacc.**—*Svensk bot. Tidskr.*, 42, 4, pp. 337–347, 1 pl., 1 fig., 1948.

This preliminary report, based primarily on a study of the material in the Herbaria of Naturhistoriska Riksmuseum, Stockholm, and the Botanical Museum, University of Uppsala, comprises a key to and taxonomical notes on 15 species of *Ophiobolus* found in Sweden, including a new species and a new combination. The author is of the opinion that *O. graminis* [*R.A.M.*, 28, p. 168] does not belong to the genus *Ophiobolus* but, as has been pointed out by several authors, is a gnomoniaceous species. As the taxonomy of the scolecosporous genera of Gnomoniaceae is at present confused it cannot be definitely placed but is probably closely allied to the genus *Plagiosphaera*. *O. herpotrichus*, having yellow-white ascospores, 15–17-septate and measuring 120 to 190 by 2·5 to 3 μ, is easily recognized macroscopically by the cloth of hyphae which often covers the substratum.

Wiltshire (S. P.). **Species of Alternaria on Brassicae.**—*Mycol. Pap. imp. mycol. Inst.* 20, 15 pp., 8 figs., 1947.

Two species of *Alternaria* occurring on species of *Brassica* and commonly confused are *A. brassicae* (Berk.) Sacc., described as *Macrosporium brassicae* Berk. in 1836, and the fungus generally known as *A. circinans* (Berk. & Curt.) Bolle (1924), or *A. oleracea* Milbrath (1922), or, wrongly, as *A. brassicae* (Berk.) Sacc. For this latter fungus the author proposes the name *A. brassicicola* (Schwein.) comb. nov.

Synonyms of *A. brassicae* include among others *Puccinia* (?) *brassicae* Montagne (1836 but later in that year than *M. brassicae* Berk.), *Rhopalidium brassicae* Mont. & Fr. (1882), *Cercospora bloxami* Berk. & Br. (1882); *Cercospora lepidii* Peck (1884); *Sporodesmium onnii* Karst. (1891); *Leptosphaeria exitiosa* (Kühn) Rostrup (1902); and *Alternaria exitiosa* (Kühn) Jørstad (1945).

With regard to this last synonym, Jørstad's transfer was made on the ground that *A. brassicae* (Berk.) Sacc. is a *nomen ambiguum*, whereas the present author considers that there is no doubt about the identity of Berkeley's fungus. Mistakes in identity do not make it impossible to use the name *A. brassicae* (Berk.) Sacc. in the correct sense. The possible synonyms *A. tenuis* forma *rapae* P. Sydow,

Cercospora crassa Sacc. f. *lunariae* Ferraris 1912, and *C. crassa* Sacc. f. *iberidis* Ferraris 1912 are all regarded as *nomina nuda*.

Helminthosporium brassicola Schwein. in *Syn. Fung. Amer. Bor.* No. 2632 (1832) appears to be the earliest name given to the species referred by Millbrath to *A. oleracea*, and by Bolle to *A. circinans* (Berk. & Curt.) Bolle. This species was recorded on cabbage leaves and examination of co-types or at least authentic specimens from Herb. Kew and Herb. Schweinitz showed spores characteristic of *A. oleracea* to be present. While Schweinitz may, possibly, have confused his species with *A. brassicae* to some extent, the author considers there are good grounds for interpreting *H. brassicicola* in accordance with the preserved specimens and proposes therefore to transfer *H. brassicola* Schwein. (altered to *brassicicolum* by Saccardo) to *Alternaria* as *A. brassicicola* (Schwein.) n.comb. *A. raphani* Groves & Skolko is accepted as a valid species.

Falck (R.) & Falck (Olga). **A new class of Ascomycetales. A contribution to the orbis vitae system of fungi.**—*Palest. J. Bot.*, R. Ser., 6, 1–2, pp. 89–106, 5 figs., 1947.

The authors express the view that the relations of an organism to its environment and its functions in that environment, referred to as the 'orbis vitae' [see next abstract] or life-sphere of the organism, should be regarded as significant in any definition of its systematic position. In the present paper the whole problem of fungus taxonomy and of the Ascomycetes in particular is discussed. It is considered that not only the structural but also the functional aspect of the ascus and ascocarp are of significance. The views are examined in relation to two fungi, a species of *Ceratostomella* and one of *Melanospora*, isolated in pure culture from timber from deciduous trees. It has been found necessary to erect provisionally new genera for these two organisms, the former being assigned to *Fugascus* and the latter to *Lysascus* [without Latin diagnoses]. These genera and the Ceratostomellaceae are placed in a new class, Haerangiomycetes, because the ascus structure fails to persist at maturity and the ascospores exude from the perithecium in a mucous mass (haerangium), being held by a tenacle of cilia at the ostiole. They are dispersed by adhering to animal vectors. Members of this group inhabit living wood, covered by bark, of felled or physiologically weakened trees.

Falck (R.). **Grundlinien eines orbis-vitalen Systems der Fadenpilze.** [Outlines of a life-cycle system of the filamentous fungi.—84 pp., 16 figs., 7 diags., J. H. de Bussy, Amsterdam, 1948.

Part I of the author's scheme for a classification of the fungi [see preceding abstract], based on their life-cycles, falls into six sections, namely, (1) *Vasomella*, *Ceratomella*, and the Haerangiomycetes; (2) the angiocarp-active Ascomycetes; (3) the gradation of the angiocarp-inactive Ascomycetes; (4) the 'ventangium' and the Ventangiomycetes; (5) the evaluation of morphological structures; (6) the division and classification of the higher fungi in the life-cycle system.

Part II comprises sections (7) the Discomycetes and their positions according to life-cycles; (8) the Vescocarpiomycetes and their new life-cycle; and (9) the Protoascomycetes and the transition to the Saccharomycetes.

Parts III and IV are stated to be in preparation.

Sarmah (K. C.). **V. Tea pathology. (B) Mycological Branch.**—*Rep. Tocklai Exp. Sta. Indian Tea Ass., 1947*, pp. 21–22, [? 1948].

In 1946 two small tea plots (90 bushes each) at Borbhetta were found to be infected by *Corticium invisum* [*R.A.M.*, 25, p. 48]. Spraying with 0·5 per cent. perenox reduced the number of infected bushes after one year from 24 to 2 while

the same material plus 0·5 per cent. alboleum eliminated the disease completely from all 34 bushes so treated.

GERSTEL (D. U.). **Transfer of the mosaic-resistance factor between H chromosomes of Nicotiana glutinosa and N. tabacum.**—*J. agric. Res.*, 76, 9–10, pp. 219–223, 1948.

In 1944, seeds of mosaic-resistant Burley tobacco, derived from Holmes Samsoun [cf. *R.A.M.*, 25, p. 527] by back-crossing to Burley and selfing, were received by the author, and three crosses between homozygous resistant plants and either non-resistant Burley or non-resistant Purpurea were grown from 1944 to 1946. Cytological observations indicated that the H chromosome was usually involved in non-conjunction [ibid., 23, p. 152]. Plant No. 45264 p 21, however, presented no non-conjunction and was selected as the male parent for further crosses. It was found that the low degree of non-conjunction between the resistance-bearing chromosome and its partner, demonstrated in this plant and its siblings, was carried over to the next generation. It is presumed that the newly acquired pairing ability of Ht and Hg must depend upon a translocation (i.e., an exchange between the two non-pairing chromosomes).

It was proved that resistance was still carried in the modified H chromosome and had not been translocated to another chromosome. It remains to be determined, however, whether the change has eliminated the *glutinosa* factors which reduce yield.

WOODS (M. W.) & ECK (R. V.). **Nuclear inclusions produced by a strain of Tobacco mosaic virus.**—*Phytopathology*, 38, 11, pp. 852–856, 2 figs., 1948.

A strain of tobacco mosaic virus designated 1C and described in a paper by Kahler and Woods (in the press, 1948) induces the formation of nuclear inclusions in Turkish and Maryland Medium Broadleaf tobacco, *Nicotiana paniculata*, *N. glutinosa*, California Wonder chilli, and Rutgers tomato. Three types of inclusion bodies occur in affected cells, namely, (*a*) crystalline or fibrous proteinaceous inclusions in the cytoplasm, (*b*) loosely aggregated, amorphous proteinaceous precipitates in the cytoplasm, the 'X-body' type [*R.A.M.*, 7, p. 256], and (*c*) nuclear inclusions closely resembling or identical with the foregoing. The crystalline or fibrous inclusions are very unstable, going into solution on mechanical injury of the cell, whereas the amorphous precipitates resist such treatment. The number of both cytoplasmic and nuclear inclusions reaches a maximum between 10 and 20 days after cell infection [ibid., 21, p. 169]. Nuclear inclusions were never observed in non-infected tissues. As Beale [ibid., 16, p. 569] and Bawden [ibid., 24, p. 137] have shown, the crystalline inclusions found in these infections are probably composed at least partially of virus. The present data suggest, therefore, that a strain of tobacco mosaic virus exists which is able to invade cell nuclei.

MCWHORTER (F. P.) & PRICE (W. C.). **Evidence that two different plant viruses can multiply simultaneously in the same cell.**—*Science*, 109, 2823, p. 116, 1949.

Tobacco and *Nicotiana sylvestris* plants were inoculated, either simultaneously or at intervals of one and four days, with the tobacco mosaic and tobacco etch viruses. Controls consisted of plants inoculated with only one virus. The macroscopic symptoms of tobacco etch usually developed one to three days earlier than those of mosaic. The symptoms of both viruses were readily perceptible in the doubly inoculated plants during onset and up to two or three weeks after inoculation. At a later stage the etch symptoms predominated, doubly infected plants being distinguishable from those inoculated with etch alone merely by a slight reduction in size.

Cytological examinations of tissue mounted in 0·85 per cent. sodium chloride were made on the 11th and 40th days after inoculation. The first examination of the material simultaneously inoculated with both viruses revealed the presence of crystalline inclusions of the two entities in every observed integumentary cell. In the case of plants inoculated first with one and later with the other virus, the leaf cells near the point of inoculation contained inclusions predominantly or exclusively of the primary virus, whereas those higher up the plant almost invariably harboured inclusions of both viruses. Forty days after inoculation nearly all the cells showed the presence of both viruses. In many cases the uppermost leaves showed only tobacco etch inclusions, while the lower ones contained both, suggesting that the crystals of this virus develop earlier than those of mosaic in old plants and helping to explain the predominance of etch symptoms. Since both the hexagonal plates of tobacco mosaic and the intranuclear crystalline inclusions of etch are closely associated with their respective viruses, the evidence furnished by these studies indicates not only the joint presence of the two entities in the same cells, but also their multiplication side by side. There was no sign of interference between the two viruses, such as that reported by Bawden and Kassanis in connexion with the severe strain of tobacco etch and potato virus Y [*R.A.M.*, 24, p. 401].

Costa (A. S.) & Forster (R.). **Ocorrência de moléstia semelhante a 'frenching' em uma plantação de Fumo em Piracicaba.** [Occurrence of a disease similar to 'frenching' in a Tobacco plantation in Piracicaba.]—*Biológico*, 14, 7, p. 171, 1 pl., 1948.

A disease similar to 'frenching' was observed for the first time in tobacco plantings in Piracicaba, São Paulo, Brazil, in June, 1947, affecting only a few plants of the hybrids 1947/1942 (Virginia Bright × Goiano) and 1947/1924 (Virginia Bright × Flor Branca). The diseased plants were abnormally small, with very narrow leaves and chlorotic areas between the tertiary veins [cf. *R.A.M.*, 27, p. 263]. The symptoms were confined to the upper leaves. Negative results were given by attempts to transmit the disorder to healthy plants by grafting and juice inoculations, showing that it is not due to a virus. Local soil conditions are thought likely to be concerned in its etiology [cf. ibid., 25, p. 237], but the symptoms could not be reproduced by growing transplants in pots containing soil from the small patches in the field where the malady occurred.

Steere (R. L.) & Williams (R. C.). **A simplified method of purifying Tomato bushy-stunt virus for electron microscopy.**—*Phytopathology*, 38, 12, pp. 948–954, 3 figs., 1948.

A new technique requiring only small amounts of diseased plant material has been devised for the rapid purification by differential adsorption of ultramicroscopic particles from the sap of *Datura meteloides* plants infected with tomato bushy stunt virus preparatory to examination by the electron microscope [*R.A.M.*, 25, p. 437]. It entails (*a*) coagulation of normal protoplasmic constituents by heating briefly to about 50° C., (*b*) adsorption of other normal components on to diatomaceous earth, (*c*) centrifugation at 3,000 r.p.m. at specific intervals to eliminate coagulum and diatom material, and (*d*) application of the suspension to films of formvar (polyvinol formal) or collodion and subsequent removal of excess liquid. Suspensions thus obtained contain innumerable particles of uniform size which are entirely lacking in preparations from healthy plants and are therefore interpreted as an integral part of the bushy stunt virus. Such preparations are actively pathogenic to *D. meteloides*. When suspensions of virus particles purified by this method are dried on films, electron micrographs reveal regular aggregates of crystalline appearance in which the lines of particles intersect at angles of 90° and 120°.

Electron micrographs of the same preparation dried on collodion show only small aggregates among numerous fairly evenly spaced particles.

Smith (P. G.) & Gardner (M. W.). **Inheritance of spotted-wilt resistance in Tomato** —Abs. in *Phytopathology*, 38, 11, p. 918, 1948.

The Red Currant tomato (*Lycopersicon pimpinellifolium*) has shown a high degree of resistance to the spotted wilt virus in the field [in California: *R.A.M.*, 23, p. 461; cf. 28, p. 52], but it is susceptible in inoculation experiments. The German Sugar tomato variety is moderately resistant to field infection. Hybrids between *L. pimpinellifolium* and the cultivated tomato have yielded lines with an intermediate resistance level. The Red Currant level of resistance was not recovered in any of its offspring and no evidence of simple Mendelian inheritance of resistance [cf. ibid., 28, p. 90] has been observed. Hybrids between German Sugar and the commercial varieties give rise to F_1 and F_2 populations of intermediate resistance. In back-crosses of the F_1 to the resistant parent the German Sugar resistance level was not recovered. The back-cross of the F_1 to the susceptible parent yielded an intermediate level of resistance. Again there was no evidence of Mendelian segregation.

Sherf (A. F.). **Occurrence of Tomato spotted wilt in Nebraska in 1948.** *Plant Dis. Reptr*, 32, 12, p. 509, 1948. [Mimeographed.]

During the last six years tomato crops in the vicinity of Lincoln, Nebraska, have suffered serious losses from virus diseases, including tobacco mosaic, cucumber mosaic, double-virus streak [? tomato streak, mixed-virus, caused by tobacco mosaic virus+potato virus X], and tomato spotted wilt.

In 1948 spotted wilt was first observed at the end of June, and within a week many fields had 30 to 40 per cent. infection. The outbreak was limited to Lincoln and its suburbs, tomato fields in other counties being free from the disease. No varietal differences in susceptibility were noticed [see preceding abstract]. Pearl Harbor, which is considered resistant to the western strain of the virus [*R.A.M.*, 27, p. 299], developed considerable infection. In one field, in which 50 to 60 per cent. of the plants developed spotted wilt, the most severely affected areas were adjacent to patches of *Convolvulus arvensis*, the leaves of which showed a yellow mottle. The juice from these plants induced typical spotted wilt symptoms in Turkish tobacco. This evidence indicates that *C. arvensis* is an important overwintering source of infection.

Aberdeen (J. E. C.). **Big bud in Tomatoes.**—*Qd agric. J.*, 67, 4, pp. 213–214, 1 fig., 1948.

The author briefly describes the symptoms of tomato big bud [virus: *R.A.M.*, 27, p. 499] on tomato and other hosts. Control consists in reducing outside sources of infection, particularly weeds on headlands, and keeping down the insect vector [*Thamnotettix argentata*] by using 0·1 per cent. DDT spray or 2 per cent. DDT dust. When the insect is prevalent, treatments should be repeated every ten days.

Howles (R.). **Plant diseases. 3. Virus diseases. The relation between the susceptibility of Tomato plants to virus infection and certain physical factors of the environment.**—*Rep. exp. Res. Sta. Cheshunt, 1947*, pp. 22–28, 1 graph, 1948.

In a study of the relation between susceptibility to virus infection and atmospheric humidity, one day before inoculation with mild tobacco mosaic virus nine tomato plants were placed in a moist atmosphere and nine in a dry one, the plants being maintained in these conditions for ten days. About an hour after inoculation the relative humidity in the moist chamber was 63 per cent. and the plants were turgid, while that in the dry chamber was 35 per cent. and the plants were wilting.

One of the nine plants in the moist chamber and five of nine in the dry atmosphere showed mottling in the head. In a second experiment the corresponding figures were 0 and two, and in a third three and five. To determine the absorption of virus by the leaf, nine plants were placed in each of the chambers (saturated and 49 per cent. humidity, respectively) for two days and inoculated half-way through this period with mild tobacco mosaic virus. None of the plants in the moist chamber developed head mottling while six of nine in the dry did so. In a second experiment the corresponding figures were one and four. These results suggest that more virus enters a wilted leaf than a turgid one. The rate of transpiration did not appear to influence the severity of virus symptoms. To determine the effect of rate of multiplication of the virus, 24 plants were inoculated and next day 12 were placed in the moist and 12 in the dry chamber for ten days. Eight of the plants in the moist chamber, and three in the dry developed head mottling. Thus for the same amount of virus absorbed the rate of symptom development is greater in the turgid plant.

In a study of the relation between susceptibility to virus infection and the amount of water added to the soil, plants were maintained at various stages of turgidity between turgid and flaccid during and after inoculation with aucuba mosaic virus [? strain of tobacco mosaic virus: cf. *R.A.M.*, 26, p. 112]. The results showed that the degree of mottling decreased with increasing amounts of water added, that is, with increasing turgidity. When, however, the plants were inoculated before being subjected to differential watering, the turgid ones proved to be the more susceptible. An experiment to determine the relation between degree of infection [of tomato plants] with potato virus X and the degree of turgidity at inoculation showed that the average number of lesions (1·5 mm. in diameter) on the three inoculated leaflets was 1·05 for turgid and 2·75 for wilted plants, the latter absorbing more virus.

Other experimental evidence indicated that unshaded *Nicotiana glutinosa* and tomato plants are more susceptible to potato virus X than shaded ones (half light intensity) [ibid., 28, 207]; and that slightly more virus (aucuba mosaic) entered [tomato] plants kept at a higher temperature than entered others kept at a lower one, provided the higher temperature was under 100° F. There is a temperature in the region of 100° at which the rate of development of virus symptoms in the plant is at a maximum. Though tomato aucuba mosaic is inactivated by 10 minutes at 80° to 90° C., it is doubtful whether complete destruction of the virus in the living plant will occur.

Tomato plants should be kept turgid in order to retard rate of entry of virus. The practice of shading glasshouses decreases the inhibitory effect of sunlight on virus development. What appears to be required is a shading or glass which is transparent to light but absorbs the infra-red radiation, e.g., a 3-mm. layer of gelatin solution mixed with formaldehyde and afterwards varnished.

WILLIAMS (P. H.). **Plant diseases. 1. Didymella stem-rot.**—*Rep. exp. Res. Sta. Cheshunt, 1947*, pp. 18–21, 1948.

Preliminary experiments on the effect of the major and of some minor elements on the ability of *Didymella lycopersici* [*R.A.M.*, 27, p. 111] to attack tomato plants are described. There was no significant difference in amount of infection (produced by adding diseased material to the soil and watering with a spore suspension) in plants sprayed with solutions containing nitrogen, phosphorus, or potassium, and those sprayed with water. When fertilizers were incorporated into the compost in which the plants were grown, it was found five weeks after inoculation that the addition of nitrogen compounds had not only made the plants more susceptible to infection but also increased the severity of the disease, as shown by the number of wilted plants. Potash and phosphate did not affect susceptibility except to a slight extent when used in combination.

In an experiment in which potted tomato plants were sprayed with solutions of some minor elements, five weeks after inoculation there was no marked difference from the controls in disease incidence except in the case of plants sprayed with manganese sulphate (0·75 per cent.), seven plants out of ten being diseased as against two in the controls sprayed with water only. In a second experiment with manganese sulphate, in which a sand-oatmeal culture of *D. lycopersici* was used for soil inoculation, almost all the plants became infected, the controls being more severely attacked than the treated plants.

Further studies on the influence of low temperature on spore germination of *D. lycopersici* [ibid., 24, p. 90] showed that the spores can withstand much lower temperatures than are normal in England in winter.

READ (W. H.). **Plant diseases. 2. Fungicides. Didymella stem-rot.**—*Rep. exp. Res. Sta. Cheshunt, 1947*, p. 22, 1948.

Soil applications of a 1 in 16,000 solution of ethyl mercury phosphate at the rate of 1 gal. per sq. yd. were carried out before planting tomatoes in several commercial nurseries in most of which severe losses from infection at the base of the stems by *Didymella lycopersici* [see preceding abstract] had been sustained for several years in spite of steam sterilization of the soil. The incidence of disease was very low even in untreated soil, but there was some evidence to suggest that the treatment was of value, and only in one nursery did it affect the growth of the plants adversely. An interesting feature of the year was the prevalence late in the season of attacks on the upper part of the stems which could not have arisen from primary infections at the base.

THOMAS (H. R.). **Effect of nitrogen, phosphorus, and potassium on susceptibility of Tomatoes to Alternaria solani.**—*J. agric. Res.*, 76, 12, pp. 289–306, 6 figs., 1948.

During 1941 and 1942, experiments were made to determine the influence of different levels of nitrogen, phosphorus, and potassium on the susceptibility of Indiana Baltimore tomatoes to infection by *Alternaria solani* [*R.A.M.*, 23, p. 37]. In three greenhouse tests carried out at La Fayette, Indiana, the young plants were grown in sand flushed daily with a nutrient solution, and sprayed in the 11- to 12-leaf stage with conidial suspensions of *A. solani*. They were then incubated for 48 hours at 70° to 75° F. A limited field experiment was carried out in Indiana on Crosby silt loam of low fertility and Brookston silty clay loam of high fertility. The plants were sprayed twice with a water suspension of conidia of *A. solani*.

By averaging all the data of the greenhouse experiments for the different phosphorus levels it was found that in two of the three experiments the plants grown at the high level (93·1 p.p.m.), irrespective of the other nutrients, had smaller leaf spots and a significantly lower percentage of dead leaves than the plants grown at the low level (none). For the different nitrogen levels it was found that in each of the three experiments plants grown at the low level (28 p.p.m.), irrespective of the other nutrients, had significantly smaller spots than those at the high level (252·1 p.p.m.), but there was no significant difference in the percentage of dead leaves on the plants receiving different nitrogen levels. Plants grown at the low potassium level (none), irrespective of the other nutrients, had a significantly smaller percentage of dead leaves and smaller leaf spots than those grown at the high level (351·9 p.p.m.) in two of the three series.

A significant interaction existed between nitrogen and phosphorus as expressed by the percentage of dead leaves, and occurred in all greenhouse experiments. In every case the higher nitrogen, low phosphorus plants had the highest percentage of dead leaves and the high nitrogen high phosphorus plants the lowest.

Plants grown in solutions with medium to high nitrogen and potassium and low phosphorus were usually the most susceptible to infection as expressed by the development of leaf spots and percentage of dead leaves. The most resistant plants were those grown in solutions with medium to high nitrogen, high phosphorus, and low to high potassium. The plants that received a high nutrient supply of all three elements at the time of inoculation had significantly smaller leaf spots and lower percentage of dead leaves than those which continued to receive solutions deficient in these elements after inoculation.

The leaf spots were larger on the older leaves than on the younger ones, regardless of the apparent nutritional condition of the plants.

In the field test there was little, if any, difference in disease resistance between plants grown at the different nutrient levels or with combinations of them.

LOCKE (S. B.). **A method for measuring resistance to defoliation diseases in Tomato and other Lycopersicon species.**—*Phytopathology*, 38, 12, pp. 937–942, 1948.

At the Arkansas Agricultural Experiment Station a laboratory test was devised for the measurement of the relative resistance or susceptibility of tomato strains and *Lycopersicon* spp. to two commonly destructive defoliation diseases, namely, early blight (*Alternaria solani*) and *Septoria* leaf spot (*S. lycopersici*). Pure cultures of the pathogens are inoculated into detached leaflets [*R.A.M.*, 25, p. 269], which are then incubated in moist chambers at room temperature in diffused sunlight, for three days for *A. solani* and eight for *S. lycopersici*. Evaluation of resistance or susceptibility is based on the diameter attained by the lesions during the incubation period.

The test proved sensitive enough to reveal small but significant differences in susceptibility to the two diseases among commercial varieties. Over a period of four years the use of the lesion diameter test has facilitated the discovery of a source of practical resistance to both the defoliation diseases, and aided progress towards the goal of incorporating genes controlling this reaction into horticulturally superior tomato strains.

ROSS (A. A.). **Tomato variety investigations in the Stanthorpe district.**—*Qd agric. J.* 67, 3, pp. 135–142; 4, pp. 200–205, 6 figs., 1948.

Descriptive notes are given of tomato varieties, recommended after more than four years' tests, for cultivation in the Stanthorpe area of Queensland. The varieties placed in Group 1, Sioux (early), Grosse Lisse (mid-season), and Rutgers and Valiant (late), are specially adapted to local conditions. Summer conditions are conducive to blossom-end rot, while later in the season the wet weather favours target spot [*Alternaria solani*: *R.A.M.*, 24, p. 478; 27, 221] and *Septoria* leaf spot [*Septoria lycopersici*: ibid., 27, p. 120]. Group 2 includes varieties which give a reasonably good crop when seasonal conditions are satisfactory. Among these, Bounty resists sun scald [cf. ibid., 25, p. 283] and Essary appears to be resistant to *S. lycopersici* and tolerant of *Fusarium* wilt [*F. bulbigenum* var. *lycopersici*: ibid., 27, p. 588], which, however, seldom causes serious losses even when susceptible varieties are grown; Norton is also resistant to this wilt, and Riverside is resistant to *Verticillium* wilt [*V. albo-atrum*: ibid., 25, p. 290; 27, p. 354]. Members of group 4 have performed consistently badly in all Stanthorpe trials, among them Pan America, very highly resistant to *F. bulbigenum* var. *lycopersici*.

WALKER (J. C.), POUND (G. S.), & KUNTZ (J. E.). **Development of Wisconsin 55 Tomato.**—*Bull. Wis. agric. Exp. Sta.* 478, 20 pp., 4 figs., 1948.

The new tomato variety Wisconsin 55 [*R.A.M.*, 28, p. 36], developed from a series of crosses in which John Baer, Del Monte, Early Baltimore, and Redskin

were used as parents, exhibits a considerable resistance to wilt (*Fusarium oxysporum* f. *lycopersici*) [*F. bulbigenum* var. *lycopersici*: ibid., 27, p. 588] in the field and is tolerant of, though not highly resistant to, early blight (*Alternaria solani*) [loc. cit.], defoliation being delayed. It matures early, has consistently larger fruit than John Baer, and outyields the latter in favourable seasons.

HAWBOLDT (L. S.) & SKOLKO (A. J.). **Investigation of Yellow Birch dieback in Nova Scotia in 1947.**—*J. For.*, 46, 9, pp. 659–671, 6 figs., 4 graphs, 1948.

After reviewing previous work on die-back of yellow birch [*R.A.M.*, 25, p. 371; 26, p. 516; 27, p. 50] the authors state that all reports tend to show that there has been a progressive development of die-back from a centre in New Brunswick into Maine, Nova Scotia, and Quebec. Annual examinations of sample areas in Pictou County, Nova Scotia, show a steady increase of the incidence of the disease since it was first reported in that area in 1944.

In the first stages the leaves in the top of the crown become small and shrivelled, or a flaccid drooping of the foliage occurs especially during dry periods. Sometimes bare twigs appear in the top of the crown, or the leaves may show virus-like symptoms. Later the twigs die from the tips backward until the whole crown is dead. The lower part usually continues to put out green foliage. The most severe damage has occurred in residual stands of birch in cut-over areas, somewhat less in undisturbed stands near cut-over areas, and least in far removed, undisturbed areas. In any one stand the damage is greatest next to the cut-over area and gradually decreases into the interior of the undisturbed stand. Die-back trees in an undisturbed stand showed little attack by the bronze birch-borer (*Agrilus anxius*) which could account for the damage in the crowns. The more or less continuous spread of the disease also tends to support the view that it is not caused by the insect. The etiology of die-back is still unknown. It is suggested that a biological factor is involved, but the possibility of fungus or virus infection remains to be proved. The evidence of spread from a cut-over to an uncut area indicates that the disease is infectious. The large roots usually have no apparent injury, but there is a slightly higher mortality of rootlets with increasing crown damage. Trees showing no crown symptoms also have a high rootlet mortality (30 to 40 per cent.). Whether this is an early stage of die-back remains to be determined.

BAKER (W. L.). **Transmission by leaf hoppers of the virus causing phloem necrosis of American Elm.**—*Science*, 108, 2803, pp. 307–308, 1948.

This is an interim report of the results of tests begun in 1940 on the transmission of the phloem necrosis virus from diseased to healthy elms [*R.A.M.*, 26, p. 269] in the Columbus district of Ohio by means of the leaf hoppers *Erynotheura* (mostly *E. campora* in all probability) and *Scaphoideus luteolus*. The evidence accumulated to date denotes that the latter is implicated in the transmission of the disease, while the role of the former is more doubtful.

STEFANOV (D.). **Sur le dessèchement de l'Orme chez nous et plus spécialement sur le dessèchement des peuplements de l'Orme dans la forêt domaniale 'Longosa'.** [The wilting of Elms in Bulgaria and more especially the wilting of Elm stands in the Longosa State Forest.]—*Gorsko Stopanstvo, Sofia*, 3, 1–2, pp. 6–13, 1 fig., 1947. [Abs. in *Biol. Abstr.*, 22, 9, p. 2244, 1948.]

During the last two or three years the [Dutch] elm disease, *Ceratostomella ulmi*, has killed many elms, especially *Ulmus campestris*, in Bulgaria [*R.A.M.*, 12, p. 252]. In the Longosa State Forest, Varna district, where *U. campestris* comprises 52 per cent. of the stand, some 150,000 cu.m. of timber have been killed, besides about 60,000 cu. m. in other parts of the country.